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From Mrs W. L. Mayo
2023 Indian Hill Rd.
Lynchburg, Va. 24503
March 13. 1978

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1868.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1869.

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REPORT

OF THE

COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE.
Washington, D. C., November 30, 1863.

SIR: I have the honor to submit the seventh annual report of the Commissioner of Agriculture. The interests confided to this department are those of an industrial class more numerous than any other, and upon whose labors, under the guidance and with the blessing of a Power that rules the year, depend the well-being and the very existence of the human family. The sphere of its operations is a territory unsurpassed for fertility of soil, and a climate favorable to the health and comfort of the husbandman, and the fruitfulness of his toil. Its marvellous breadth of area invites the toiling millions of the world, offering to each family a farm and a home, with the added boon of citizenship, and asking in payment only a guarantee of improvement, and a share in the production of the bread of a nation. It is the function of this department to aid this great foundation interest in all legislation affecting it, in the diffusion of practical information concerning it, and in the dissemination and testing of rare and untried plants of other countries, that promise to enrich its store of production. This work involves a familiarity with the latest discoveries of the natural sciences and a knowledge of the technicalities of many arts, with a fund of practical knowledge and sturdy sense that intuitively judges aright in all the actualities of every-day life. If its true object and proper function are understood, a work of great magnitude and importance is opened, requiring a variety of skilled official labor, and special training, in preparation for it. A beginning has been made, small it may be, but foreshadowing, it is believed, a future fraught with a good to agriculture and to the country. Difficulties have been encountered, and discouragements met, but the obstacles are disappearing and shadows lightening, and the way is open for rapid progress and a successful career.

AGRICULTURAL EDUCATION.

The industrial colleges now springing into being throughout the northern and western States, though various in character and aims, and at present in the weakness and inefficiency of their infancy, are destined

to be powerful coadjutors in the legitimate work of this department. Already has the discussion attendant upon their organization elicited inquiry, corrected prejudices, diffused information, and aroused enthusiasm for a practical education, which cannot fail to accomplish good results. They are calling forth from the ranks of the professions, and of educated, practical farmers, earnest men of enlarged views, and training them for the position of teachers in these institutions, thus opening spheres of usefulness to which schoolmen have hitherto been strangers, and eventually making a new era in the education of the world. The material for these professorships is yet in the rough, and must be fitted and polished in the institutions themselves; and as this is a progressive work, the country must be patient, not expecting the culmination of a century of progress in a moment of time.

SYSTEMATIC AGRICULTURE.

Hitherto this country has been characterized by random farming, for immediate results, with no reference to future advantages, and no persistent following of any prescribed course. It has been a speculative business, with a constant endeavor to overreach the soil, even at the risk of its bankruptcy. Cotton, wheat, wool, hops, and other products have been, either periodically or locally, the innocent causes of unnatural excitements, and it may be long ere cool reason shall hold undisturbed sway among our husbandmen; but there are evidences that more stable views and more systematic practices are beginning to prevail. In the central settlements of the west, farm animals, the basis of systematic farming, are held in higher esteem than formerly, and a preparation at least is made for some simple rotation of crops. More stability exists, under adversity, as in the case of wool-growers, many of whom, far-seeing and wise, are confident of future profit in the midst of present discouragement. There is a disposition in the south to produce their own bread and meat, and hold their cotton as a surplus, bearing a better price when the quantity does not suffice to glut the market. These and many other signs of thoughtfulness and growing wisdom are apparent.

SOUTHERN AGRICULTURE.

It is gratifying to observe the evidences of vitality in southern agriculture, which is progressively and successfully marshalling the forces of recuperation, and gradually dispelling the despondency resulting from the losses of civil war, the change in the labor system, the disruption of families and the impoverishment of estates. This despondency, together with political disappointments, led to chimerical plans for settlements in Brazil, in Central America, in Mexico, and even in the northern and northwestern States. I have regretted and combatted, in personal intercourse and correspondence, this morbid tendency to expatriation, or to distant removal, as an aggravation of the evils of poverty

and discontent, rather than their cure. It is a self-evident proposition that forced sales of remnants of property, mostly real estate, at a place and time in which few purchasers have disposition or ability to make investments, are not favorable to a conservation of reduced estates; and the expenses of removal would leave emigrants in a condition of more abject poverty, among strangers, and surrounded by unfamiliar circumstances and occupations. There is abundant evidence of gradual tranquilization of discordant social and business elements, and an increasing hopefulness and energy in industrial effort. An impetus has been given to business by the introduction of northern capital; and in the future more rapid progress may be expected from the same cause. Money, population, and skill in special industries, are the requisites for success in developing the resources and extending and perfecting the agriculture of the South.

In view of all the circumstances affecting cotton culture, it may be deemed a remarkable fact that the yield has attained an equality with that of 1850, and is half as great as the excessive product of 1859 and 1860, which glutted the markets of the world, and would have caused a discouraging depression in prices but for the cessation of cotton production in the years that followed. The cash receipts for the crop of 1867 were larger than those of 1859, though of less actual value as reckoned in a depreciated currency.

The sugar interest is rapidly attaining prominence, the product having doubled in the last two years. The total product of rice is also increasing.

CANADIAN RECIPROCITY.

The farmers of the country, while enduring the necessary burden of internal revenue taxation, and submitting cheerfully to imposts upon all foreign products consumed by them, will enter a vigorous protest against any proposition for the renewal of the abrogated reciprocity treaty, or any arrangement admitting untaxed and low-priced Canadian productions customs free, or at a lower rate of duty than is provided in existing laws regulating the tariff upon similar imports from other nationalities. They justly demand equality in taxation and in exemption from its burdens; they ask no favors for a class pre-eminent in numbers that they would not accord to one of the smallest in the nation, and properly regard with jealousy any assumption of claims for special privileges for the few at the expense of the many. They cannot see the justice of subjecting farmers to a direct and ruinous competition in wheat, beef, wool, and all products of the farm, along a line of thousands of miles in extent, for the benefit of foreigners who bear none of our burdens, and for the enrichment of a few of our citizens who stand in a necessary yet unproductive position between the producer and consumer. Such treaty of reciprocity would bear with peculiar hardship upon the wool-growing interest, and especially upon the production of combing-wool,

the long wool of Canada, a fiber in growing demand, which our farmers can readily supply, and at the same time furnish the markets with mutton of superior quality, if no unjust discrimination is permitted in the practical working of the wool tariff. Whatever settlement of questions of navigation or fisheries may be desirable, it is hoped that no advantages may be secured by concessions prejudicial to the farming interest.

INTERNATIONAL EXCHANGES.

A system of international agricultural exchanges has been established with many of the governments of Europe, Asia, and South America, already including Austria, Prussia, China, Japan, India, Guatemala and British Honduras. Arrangements have also been made for valuable exchanges of rare seeds, plants, trees, and various products of agriculture, with the botanical gardens of Kew, in England, and Melbourne, in Australia; the India museum, in London; the Cape of Good Hope Agricultural Society; the botanical department of the British museum; the commissioner of patents of the Argentine Republic, and the Central Agronomical Society of the Grand Duchy of Posen. Correspondence, in initiating this measure, has elicited expressions of the utmost cordiality and a cheerful readiness for zealous co-operation. The arrangement with Doctor Forbes, of the India museum in London, contemplates a general exchange of the agricultural products of the United States for those of India. He proposes that similar specimens shall bear the same numbers, in the India museum, in London, in that of this department, and in the local museums of India, for the purpose of facilitating reference at London, India, or in the United States, or any other country to which similar collections may be sent. Among the samples are nearly one thousand specimens of the textile fibers of India. It is my design to extend and complete this system of exchange, which promises valuable results to agriculture, and incidentally to manufactures and commerce.

DISEASES OF FARM STOCK.

The prevalence of fatal maladies among all varieties of farm animals, resulting in the annual loss of not less than fifty million dollars, demands the prompt attention of this department, the vigilance of the agricultural associations, and national and State legislation. The past year has not been one of peculiar misfortune in this respect, except in the dissemination of the splenic fever, communicated by Texas cattle; yet, horses, mules, sheep, and swine have all suffered from the local prevalence of malignant forms of disease, against which little veterinary skill is opposed, and little more than empiricism and superstitious folly is practiced. A disease may suddenly decimate the cattle or horses of a neighborhood, the only popular knowledge of which is the statement that it is a murrain or distemper. A disease exists locally in several of the south-

ern States, by which the total loss of a plantation's stock of horses and mules not unfrequently occurs, with scarcely an effort or hope for a cure. The annual losses in swine cannot be less than ten or fifteen million dollars by the disease commonly known as "hog cholera," for which no remedy has been found; and prevention has proved difficult and uncertain.

On the breaking out of the splenic fever at the halting places of Texas cattle during the past summer, I commissioned Professor John Gamgee, of the Albert Veterinary College of London, to investigate its character and causes and the means for its prevention. The labor was undertaken at once and continued with zeal and activity in several western States, including the Texas cattle stations of Western Kansas. Post mortem examinations, not only of diseased native stock but of the cattle from Texas, were repeatedly made, and their results carefully recorded, all tending to connect the migrating herds of the Gulf coast unmistakably with the existence and spread of the disease. The report of this investigation, enriched with valuable material collected by the statistical division of this department for a history of the outbreak, will be presented to Congress at an early day, together with a statement of the previous history of this disease in this country, and chromo-lithrographs of internal organs of animals dying from the disease. The department has been cramped for means to conduct this investigation, having no fund from which to defray its expenses, except that for statistical purposes, which is quite too meagre for the absolutely indispensable demands upon it, and congressional aid will therefore be requisite for the completion of the work undertaken and for the proper publication of the report upon it.

While it is deemed important to investigate the cattle diseases prevalent, and to obtain the best professional aid in seeking to diminish the extent of their ravages, it is evident that effort directed toward the cure of any disease which is well developed in any section of the country must be very unsatisfactory and ineffectual. Many of the diseases of cattle, as of men, have their origin and distribution in the unnatural and unhealthy conditions of their growth and management, naturally resulting from what is termed our civilization. These diseases belong to the class of ailments which are preventable. Their causes are known, and means of prevention are at our disposal; and if an enlightened state of public opinion leads to the formation of societies for the prevention of cruelty to animals, a higher appreciation of the dependence of domestic animals upon us, not only for food but for care and protection from disease, should lead to the formation of establishments for the study of cattle in health and disease, and the training of a class of practitioners who would bring the highest medical skill to the treatment of our domestic animals. If motives of humanity should fail to influence, self-interest, in view of the annual losses of millions of dollars in valuable property, should be a potential inducement to prompt action in this direction. The formation of veterinary colleges—not for the treatment of animals, but for the

education of a class of practitioners of skill and science, who might become beacons, warning the proprietors of stock of the approach of disease, and pointing out the means of prevention—has been adopted in many European States, from which much benefit to the community has been derived. I consider it eminently the duty of this department not only to point out the want of such an institution but to initiate its establishment; and I earnestly hope that Congress may authorize at an early day the creation of a division of veterinary surgery for the investigation and prevention of diseases of domestic animals, and for the advancement and diffusion of veterinary science and for its most efficient and beneficent practical operation.

GRAPES AND WINE.

The production of grapes for table use and for wine making has become an interest of great importance. The introduction of new and improved varieties is rapidly cultivating a discriminating taste in the general public, which must be gratifying to those who have labored long and faithfully in its dissemination. The difficulties to be encountered, and the conditions most favorable to success, are now pretty well understood, and such as still remain in doubt cannot long escape the investigations of the many intelligent cultivators now engaged in solving these practical problems.

For many years this interest was greatly depressed from a general belief that our native grapes were incapable of improvement, or that the foreign wine grapes were of so superior a quality as to supersede the fruits produced from American species. Vast sums of money, and much valuable time and labor, have been expended in the endeavor to make the foreign grape a success, but without exception it has proved a failure in open air culture. These failures, however, have had a salutary effect in directing attention to the improvement of our indigenous species, and the progress of amelioration is both marked and rapid, and must certainly at an early day succeed (if it has not already succeeded) in producing varieties of equal merit to those famed for their excellence in Europe. Notwithstanding these well ascertained facts, communications are frequently received from gentlemen of large European experience in making wine, who have come to this country for the purpose of entering upon grape culture, urging very strenuously the importation of the foreign varieties, and expending their own means in this futile effort. It is to be regretted that the hard-earned experience of others is not taken as a guide, but the fact will be learned, sooner or later, that east of the range of the Rocky Mountains no climate has yet been found suitable for the continued healthy growth of the foreign grape. On the Pacific coast the plant seems to find a perfectly congenial climate.

SUB-TROPICAL FRUITS.

Considerable attention is now being directed to the introduction and culture of tropical and sub-tropical fruits in the southern States. The

climate of Florida is especially favorable to these productions. The department has for some time past been collecting fruits of this description for the purpose of introducing them into the most favorable regions, and is in the possession of much information with regard to the climate, and its suitableness for these useful products.

CINCHONA PLANTING.

Among the "new and valuable plants" which the organic law of the department requires it to propagate, cultivate, and distribute among agriculturists, there may be included not merely those useful as food stuffs, or for industrial arts and manufactures, but also those which subserve the sanitary interests of the people. European governments, possessing intertropical colonies, have already taken the lead in the introduction and acclimatization of medicinal plants within their own limits. I would especially call attention to the necessity which has arisen within the last few years for the initiation of prompt measures by the government to obviate the results of the extinction of the cinchona forests on the Andes, which is caused by the negligence of the governments of Peru, Ecuador, and more northern Andean states. The experiments of England, Holland, and other countries, have shown how readily new plantations of cinchona trees may be established in suitable localities, how rapidly the species becomes acclimated, and how early it yields satisfactory returns, and how easily such enterprises are popularized and rendered profitable. The supply of quinine has become a necessity of existence, not merely as a cure, but as a prophylactic agent. During the late war many thousand lives were saved by its use alone. In view of the approaching extinction of the cinchona species, (unless intelligent governments introduce the cultivation within their own territories,) I would earnestly recommend that an appropriation be made by congress to introduce it, and to propagate and establish a cinchona plantation under the care of this department. The attention of the public has already been called to this subject in the annual report for 1866, and the present is a fitting time for carrying into effect the plan there recommended.

THE STATISTICAL DIVISION.

The operations of the statistical division include the collection of the facts of agriculture in its widest range, from all the States and Territories of this country, and the gleaning of similar data, for purposes of comparison and instruction, from European records of experimental science, the transactions of societies, and official bulletins and publications. It involves the tabulation and systematic arrangement of this matter, and the publishing of condensations or deductions from it in a monthly report. The compilation, composition, revision, and publication of the annual volume is also intrusted to this division. The importance of this work will readily be acknowledged, and it is to be regretted that it has

of late been cramped for means to carry out plans for its improvement and prompt issue. While the cost of publishing the last volume was about $100,000, the appropriation for its preparation, together with the matter for the monthly, the statistical data on file for reference, and all special statistical investigations whatever, was last year but $10,000. It is in no sense commensurate with the objects to be accomplished, and would inevitably fail of realizing any valuable results but for the untiring industry and perseverance of those engaged in the work.

The crop statistics of the present year indicate a more than average condition of agricultural prosperity. The wheat crop is somewhat larger than last year, the increase being about equal to that of the population, and may be estimated at not less than two hundred and twenty million bushels. The corn crop is much larger than last year, but may not be placed, on completion of the tabulation, at more than nine hundred million bushels. The cotton crop, although of slightly reduced acreage, would have been excessive but for the damage from army and boll worms, yet the result will exceed two million three hundred thousand bales. For details of crop reports, and numbers and condition of farm stock, reference is made to the report of the statistician.

THE CHEMICAL DIVISION.

During the spring and early summer of this year, the laboratory has been engaged in analyses of samples which had been forwarded by correspondents from various parts of the United States. In great part these examinations were directly in the interest of farmers, or of those whose avocations are connected with agriculture. The variety of work has been similar to that of preceding years, embracing the examination of minerals, ores, earths, products from various manufactures, special investigations in technical branches of industry, and analyses of field products. The amount of work which flows in upon the laboratory is necessarily large, from the great extent of territory whence it is derived, and the number of our correspondents. In former reports the numerous instances in which parties seek to use the laboratory to further private interests have been alluded to, and I take occasion to repeat with emphasis that the proper aims of an agricultural laboratory cannot be subserved under a practice which admits of a constant and desultory occupation of the time of the chemists. A large force of practical analysts, with copyists and clerks, would be required to dispose of all the scientific work which has thus accumulated under the former interpretation of the duties of this division. In the future the increase of this species of service will not be deemed advisable, for, although it yields much information which is beneficial to localities, it absorbs attention which might otherwise be devoted to work of more general utility. From the month of July to the present time, but little analytic work has been done, owing to the transfer of the laboratory from the Patent Office building, and the necessarily slow performance of the work of refitting.

In compliance with circulars from this office addressed to various State agricultural societies, requesting samples of average quality of the cereal crops of this year, for the purposes of chemical analysis to determine their relative richness in food elements, returns are being received. When the number is complete, so as to represent the production of the whole country, this extensive investigation will be undertaken, and will form the burden of the work of the laboratory for the coming year. It is by means of such experiments, which no individual society or institution could successfully prosecute, that the department may be made most useful to the country.

The appropriation destined for the laboratory has been nearly expended in the general fitting up of the laboratory with new cases, shelving, tables, and in the renovation of the old work.

Through the courtesy of the Smithsonian Institution, the department has been enabled to purchase to advantage in Europe chemical apparatus and materials, which have been forwarded with care and have arrived in safety. The purchase was made in the most judicious manner, considering the sum which remained for use after the necessary expenditure in fitting up the cabinet, &c. The laboratory will be in a few weeks, when all shall have been put in place, in good working order, and well adapted for the general applications of chemistry to analytic purposes. As so much of the current appropriation has been expended on wood-work, the chemist has been unable to obtain all of the fine chemicals and chemico-physical apparatus which a government laboratory needs in order to be prepared for that variety and amount of general or special work to which such an institution should be devoted. It is proposed that the appropriation of the coming year be allocated to this purpose.

The necessity of connecting a chemical laboratory with the Department of Agriculture has been admitted; but it may be affirmed that the direction in which it should be employed is hardly yet appreciated. It is only by reviewing the work done in European laboratories, which are fostered by the several governments, that the right application of an agricultural laboratory is rendered apparent. That chemical science may be brought in more immediate connection with agricultural experiences, there should be established an experimental garden as a portion of the general farm, having for its special object the cultivation of plants or crops, under certain specified conditions, in which every element of growth may be under observation. It is by such co-operation of garden and laboratory that those researches of Payen, Boussingault, Ville, Hoffman, Corenwinder, and others, have been carried out; and I would therefore recommend that an appropriation be made for this purpose.

As an integral part of this division there has been commenced the formation of an economic mineralogical cabinet, which will serve not only to illustrate the relation of soils to the parent rock, but will also form the nucleus of an industrial collection, illustrating the lithological riches of the country which are available for architectural and other art purposes.

ENTOMOLOGY.

The labors of the entomological division have greatly increased during the past year. Letters of inquiry in regard to insects destructive to the crops have been far more numerous than formerly. The ravages of the cotton army-worm at the south, and of the potato-bug and locust at the west, have aroused the attention of farmers and cultivators generally, and excited an unusual degree of interest in the subject of practical entomology.

As lands are brought under cultivation, insects which formerly preyed upon indigenous weeds, finding cultivated plants more attractive and congenial food, have multiplied so rapidly as to alarm the farmer and stimulate inquiry into their habits and the means for their destruction. Letters on these subjects are daily received, many containing specimens of the insects either known or supposed to be injurious, with details of the damage done, the means used to prevent their depredations, and the success or failure attending them. This correspondence is filed as a record of the progress of entomology. All the insects thus received, if new or hitherto undescribed, have been figured by Professor Glover, and copies of the plates, twenty to thirty in number, have been added to the large collection in the museum, now comprising about one hundred and eighty plates, containing from twenty to fifty figures each. These insect illustrations, accompanied as they are by names and references to habits and means of destruction, form one of the most useful and instructive features of the museum of which they are a part.

THE MUSEUM.

In removing from the Patent Office to the new building of the department it was found that many of the specimens of natural history were so much injured by dampness and consequent mold as to be unfit for the uses of the collection; these were destroyed, and it will be necessary to replace them with new and better types. It is also deemed important to procure type specimens of pure-bred domestic fowls, and some of the smaller farm animals.

Now that adequate accommodations are furnished for the museum, it is hoped that greater interest will be shown by agricultural and horticultural societies of the different States, and that samples of grain, fruits, &c., will be more freely contributed than heretofore, so that each may be fully represented at the capital of our national government. It is designed as soon as possible to duplicate this collection, for the purpose of aiding the several States to establish museums of their own, in which the agriculture and natural history of the various sections may be correctly represented.

There are already collected about fifteen hundred samples of foreign cereals and vegetable seeds, which for want of room and proper conveniences have never been exhibited; and about the same quantity of native grains, seeds, &c., a portion of which were shown in the old rooms. It should be understood that this is not intended to be a mere collection

of beautiful, unique, or curious specimens, but a cabinet of reference, where the merits of each group may be shown, together with their uses, habits, and adaptability to various sections of the country. It has been planned with a design entirely utilitarian by the entomologist and naturalist of the department, under whose special charge it is, and who has here created a substantial foundation for a great national agricultural and economic repository of useful knowledge. A glance at what has already been done, and a consideration of the scope and bearings of the plan, cannot fail to recommend it to popular favor and insure its permanence as a most desirable adjunct of the department, worthy of the fostering care of the government.

EXPERIMENTAL GARDEN.

The distribution of plants from the garden during the past year embraced thirty thousand plants. Many thousands of scions and cuttings of fruit trees have also been disseminated. Great care is taken to preserve the nomenclature, to guard against errors in the numerous varieties cultivated. The utility of the garden is not confined to the propagation and distribution of useful plants. The information derived from observation of their growth is of great benefit to the department in its correspondence. Questions relative to fruit trees, medical, and other useful plants, are daily considered, which could not be satisfactorily answered without the aid of the garden. The progress of horticulture has never been so rapid in the country as it is at the present time; and the great increase of new fruits and plants demands vigilant attention and considerable means to maintain and complete the collection, since the knowledge derived from experiments with new varieties to be useful must be prompt.

It is necessary that the legitimate operations of the garden should be kept in view. It cannot be either useful or expedient for the department to propagate or disseminate plants indiscriminately, a supposition that seems prevalent, judging from its correspondence. Orders are received for almost every description of plant, entailing a vast amount of unnecessary correspondence, since all such orders are entirely out of place, and utterly beyond the means and inconsistent with the objects of the department.

DEPARTMENT GROUNDS AND ARBORETUM.

The grounds connected with the new building are being rapidly improved. The adoption of a well-matured plan, before commencing active operations, has tended to facilitate the execution of the work at those points more immediately pressing. The roads and walks in close proximity to the building have been constructed as far as practicable with the time and means at command. A portion of the main road has been finished with a concrete surface, which has proved even more satisfactory than was anticipated. This road, while it is no more expensive than one of granite properly macadamized, has many and great advan-

tages over one constructed in that mode. It at once presents a smooth, hard surface, which it constantly maintains, and its entire freedom from vegetation, such as mosses and other weeds, will be an annual saving of many hundreds of dollars, with the additional advantage that there is no probability of any necessity for repairs.

The main feature of the plan is the arboretum. This it is proposed to make as perfect and complete in species and varieties as the climate will admit, and will prove of great benefit in the workings of the department. With a strictly botanical arrangement the idea of landscape effect is happily combined; and in designing the roads the ultimate connection of the contiguous reservation has been kept in view, admitting of a uniform style of improvement with the surrounding grounds in the highest order of landscape gardening. This, in addition to the intrinsic utilitarian value of the collection, cannot fail in giving great attraction to these grounds.

The department is constantly engaged in procuring specimens of rare plants for practical uses. The most important of these are collections of both hardy and exotic plants used in medicine, the fine arts, dyeing, and in manufactures. In the arboretum will be found all that are sufficiently hardy to stand unprotected in this climate; but the most valuable will require protection—some constantly, others only during the progress of acclimatization. A commodious range of glass structures should therefore be provided at once for these purposes. A design with detailed plans of suitable buildings is in course of preparation, and will be submitted for consideration when completed.

CULTIVATION OF RURAL TASTE.

While all these improvements will be highly utilitarian in their aim, the love of rural life is worthy of the most careful culture. In this connection it is proper to observe that one of the most certain means of encouraging a taste for rural pursuits, both in agriculture and horticulture, and of instilling a desire for the study of botany and vegetable physiology, is that of proper embellishment of school-house and college grounds. Surround these seats of learning with an extensive variety of trees and shrubs, with the name of each conspicuously attached, arranged with artistic discrimination, and the minds of students will necessarily be drawn to the study of the vegetable kingdom. To know how to plant and cultivate a tree should certainly be a knowledge possessed by every person, whatever his proposed profession or aim in life. This is obvious to every reflecting mind; yet there is a total want of this variety of external attractions in these institutions, for which there is no possible excuse.

DISTRIBUTION OF SEEDS.

The seeds contracted for by my predecessor, (with the exception of the wheat, which was imported by myself,) under the very liberal appropriation of the past fiscal year, have been distributed extensively, and as

judiciously as the nature of the case would admit. Among the thousands of applicants for these favors from every portion of the United States it has been difficult always to discriminate, but great care has been taken to place them in the hands of those appreciating most fully the object of the government in the appropriation, and their obligation to the department to make the most intelligent and careful test, to disseminate the product throughout the community in which they reside, and to report to the department the results of experiments. While many recipients give little attention to the invariable request going forth with every package of seeds and plants, it is gratifying and encouraging to note the reports of many successful experiments, especially upon the staple cereal products. The result of a single importation of wheat has alone been worth more than an annual appropriation for the whole department.

Our floral wealth has been enriched by the introduction of new and rare varieties of seeds and plants. Much attention has also been given to the extension of our knowledge of pharmaceutical plants, and their adaptation and acclimatization in various portions of our widely extended domain. The same may be said of the fiber-producing plants. The cultivation of the citrus family, and other sub-tropical productions, and their introduction into Florida and other portions of our country favorable to their growth, has received earnest attention.

From every portion of the globe seeds and plants, and information as to their culture, have been successfully obtained, and the results promulgated through the annual and monthly reports. The care bestowed upon this work, in reforming the former pernicious system has been onerous and difficult, but I trust will ultimately be properly appreciated even by those whose individual interests may have been affected, and approved by enlightened agriculturists of the country as one more worthy of the nation.

Every day's experience develops the importance of a more liberal appropriation for this particular branch than was given it for the present fiscal year, which was less than a third of the appropriation of the previous year. New objects in this connection have been developed demanding special attention. The arrangements for an extended exchange with foreign countries of our valuable cereal and forest tree seeds properly come under this head, and will draw heavily upon this limited appropriation; but it is viewed as one of paramount importance, and destined to add greatly to our national wealth.

The economy of a judicious distribution of seeds by the national government is scarcely understood or appreciated. An illustration or two will prove suggestive in investigating its benefits. At a low estimate our wheat yield is reduced six bushels per acre by cultivation of new lands for ten years. If one bushel per acre only is accredited to seed deterioration that might be remedied by a proper wheat distribution, the aggregate will be eighteen million bushels, worth $30,000,000. Oats degenerate more rapidly than wheat, and it is perfectly practicable to increase the value of the crop ten per centum by change of seed, and this

increase should at least be equivalent to $15,000,000. And so the benefit might be aggregated till it represented more millions than the seed distribution of this department has ever cost in thousands in any year of its existence. If nine-tenths of the seed distributed are sheer waste, and a single tenth is judiciously used, the advantage to the country may be tenfold greater than the annual appropriations for agriculture. This is fully shown by the records of the department.

The following statement exhibits the disposition made of the seeds under the appropriation from the 1st December, 1867, to 1st December, 1868:

Total number of packages and papers distributed, 592,398, which includes 32,127 sacks of winter wheat imported by the present Commissioner, as follows: To members of Congress, 223,672; to agricultural and horticultural societies, 98,861; to statistical correspondents, 86,391; to individuals on applications, 183,474; total, 592,398.

FINANCIAL.

In presenting for your consideration the financial condition of the department, it is gratifying to have it in my power to state that the expenditures under each appropriation have come within the sums appropriated.

There has been expended since December 4, 1867—the date of my entry upon the duties of Commissioner—$217,400, leaving a balance unexpended of $103,600 for the remainder of the fiscal year ending June 30, 1869.

The report of Mr. Cluss, the architect employed to superintend the erection of the building, and the necessary fitting and furnishing, shows the completion of the whole in a substantial and workmanlike manner, embracing the laboratory with its new and complete chemical apparatus, and the museum with its convenient and tasteful arrangement of cases, and the library, at a total cost of about $140,000.

The balances under each head are deemed sufficient to meet all future demands of the present fiscal year.

In view of the completion of the building in all its internal arrangements, the sphere for the operations of the department has been materially enlarged, and it is now prepared to assume its proper rank as the representative department of a largely predominating class.

The work of each division, with its *modus operandi*, has been outlined in this report, and new ideas suggested by the working of the department have been advanced for your consideration as worthy the encouragement of Congress as a part of the whole system, and in fact indispensable to its successful operation. My estimates for the next fiscal year are based upon these important measures for the enlargement and diversification of the industrial interests of the country, and I trust they may be met in a liberal and justly appreciative spirit.

HORACE CAPRON, *Commissioner*.

His Excellency ANDREW JOHNSON,

President of the United States.

REPORT OF THE ARCHITECT.

WASHINGTON, *November* 20, 1868.

SIR: I have the honor to report the completion of the work under the contract for erecting, fitting up, and furnishing the new building for the accommodation of the department under your charge. All the work enumerated in the estimate has been done within the limits of the appropriations made by Congress.

In executing the work a strict compliance with the letter and spirit of the appropriation bills was adhered to throughout. The appropriation for all the work, properly within the province of the builder, being under one head, it was advertised for according to law, and given out *in toto* to the lowest responsible bidder. The appropriations subsequently made for fitting out and furnishing the building being under separate heads, were given out directly to mechanics and business men of highest reputation in their different branches. Superior quality of work and material have thus been obtained at very moderate rates.

The isolated position of the building has involved a considerable outlay for the connections with the gas-works and water-works of the city, as also for sewerage leading to the Washington city canal.

The building is now finished, with the exception of a few rooms in the basement and the attic story, which were not included in the estimates. An abundant supply of gas has been provided for, since it forms the heating power for the operations in the laboratory. Aside from the supply of water for the accommodation of the office rooms, laboratory, closets, and boilers, pipes of extra size have been carried up, feeding fire-plugs in the several stories. A steam-heating apparatus is in successful operation; the boilers being of sufficient size to heat also the attic story when finished.

All the principal rooms and corridors of the building have been laid off in chaste panels, painted in encaustic oil colors, the ceiling being frescoed. The vestibule and main staircase have received a strictly artistic finish. The large hall in the second story, appropriated to the museum of agriculture, has been frescoed with due regard to its national importance, the coat of arms of the United States, surrounded by the escutcheons of the thirty-seven States of the Union, taking a prominent part in the embellishment.

The American wood-hanging, that ingenious new patent which makes the products of the forest in their primeval beauty directly subservient to the highest efforts of the decorator, appeared peculiarly fitting, and has been applied for the finish of the suite of rooms occupied by the Commissioner.

Candelabras and massive chandeliers have been put up at all places where there was an immediate necessity for them.

All the office rooms of the building have been furnished with substantial carpets, and the desks, furniture, and cases, have been replenished to the full extent of the means at command. The laboratory has also been fitted out of the appropriation for the building with a fine set of new instruments and apparatus, which was imperatively required for the transaction of the chemist's operations.

The museum has been partly filled with absolutely dust-proof cases of solid walnut shaped in the best style of the art, each case being glazed with three hundred square feet of pure white glass, and provided with

the most approved bronzed locks and fastenings. The insufficiency of the appropriation could not have been construed to require a full supply of indifferent material and workmanship.

The sum total of all the appropriations expended, inclusive of sewerage, furniture, carpets, and scientific apparatus for laboratory, is $140,420, and the building contains five hundred and sixty-five thousand cubic feet of available space. The cost is, therefore, but twenty-four and three-quarter cents per cubic foot, which compares most favorably with any similar edifice erected by government or private individuals.

ADOLPH CLUSS, *Architect.*

Hon. HORACE CAPRON,
Commissioner of Agriculture.

REPORT OF THE STATISTICIAN.

SIR: I have the satisfaction of reporting another year of agricultural prosperity, in which garners have been full, and food products for the sustenance of forty millions of human beings have been abundant, and within the means of the humblest, while prices have been moderately remunerative to the producer.

The tendency of population to the cities and to unproductive and speculative employments is less marked than heretofore; the young man, looking for a career of business, now turns to agriculture as an industry worthy of his education and aspiration. The capitalist, unlike the speculator holding as a desert thousands of fertile acres, now, sometimes, enters the arena of agriculture, and shows the farmer, doubtful of the profit of his business, that a man of brains and means can legitimately hold and thoroughly and profitably cultivate ten thousand acres. The defeated warrior in a cause forever lost is patiently and cheerfully following a war-horse that is now a plow-horse; and the freedman, unused as he is to self-control and proverbially unmindful of his coming wants, is more faithful and efficient as a free laborer than he was in previous years. Invention and mechanical skill were never more active and beneficent in their gifts to productive industry. All these favorable indications point to increased abundance in the future to meet the requirements of a rapidly increasing population, and a more ample and luxurious style of living.

The approaching completion of the Pacific railroad is already opening to cultivation the fertile plains that were formerly held as deserts, and the valleys of the Rocky Mountains, enlarging our field for the collection of agricultural statistics, and furnishing home supplies to the miners and railroad builders of the new west.

The extent and constantly changing condition of our vast territory render attempts at detailed estimates of production somewhat hazardous; yet, so far as opportunity has been afforded for verification, the results have been quite satisfactory. As to the new and rapidly growing settlements of the West which were scarcely commenced at the date of the last census, it is simply impossible to attain a high degree of accuracy without a careful census annually.

The usual tabulations of estimates are preceded by more comprehensive statements concerning the principal crops of the country.

WHEAT.

A disposition to increase the breadth of wheat-planting was evident early in the season, and in all parts of the country. New England felt the impulse slightly in the spring sowing, though the eastern crop scarcely affects the grand aggregate. The increase was mainly in winter wheat, except in Minnesota, Iowa, and Nebraska. Texas failed to attain the acreage of the previous year, and Kentucky and Wisconsin scarcely equalled their area in 1868.

The early reports of condition were generally favorable, and noted by the absence of winter-killing, except to a very limited extent, principally in Kentucky and Tennessee. Rust was prevalent only in small areas, and to a slight extent; and was more frequently reported in the States between Maryland and Georgia, and in Kentucky, than elsewhere.

In June the prospect was unusually cheering, promising a better yield than in any season since 1863, and with a larger acreage than ever before, rendering probable an aggregate production of nearly a bushel *per capita* more than the supply of the previous year. The excessive heat in the latter part of June and the month of July, which served to perfect the grain in deep, well drained soils, wrought decided injury in checking the full growth of the stalk and shriveling the ripening kernels, in loose prairie soils, and in undrained, surface-scratched fields, so numerous in the defective cultivation of the present day. There was little complaint of insect attacks, and quite as little loss from blight and rust, or casualties of any kind, yet the loss to production by this unsuitableness of temperature to soil and cultivation was probably not less than twenty millions of bushels.

The estimated increase over the previous crop (of 212,000,000) was about 18,000,000, the aggregate production of 1868 being estimated in round numbers at 230,000,000 bushels. This increase was obtained west of the Mississippi, the older States failing to furnish the quantity *per capita* produced in 1867—failing to advance with increase of population.

Progress of wheat-growing westward.—The progress of wheat-growing westward is a significant feature of our agriculture. In nine years, since 1859, it has been out of all proportion to the increase of population in the same section. West of the Mississippi, in 1859, the quantity harvested was about 25,000,000 bushels; in 1867 it had increased to 65,000,000 bushels; and in 1868 the product was 70,000,000 bushels. Nine years ago the proportion produced was but fourteen per cent.; now it is thirty per cent. of the total product. At this rate of increase more than half of the wheat of the country, ere many years shall elapse, will be grown west of the Mississippi—probably before this western section shall have half the population of the area east of it.

A comparison of the movement of wheat production in some of the principal wheat-growing States will illustrate this state of facts:

State.	1849.	1859.	1868.
Minnesota	1,401	2,186,993	14,500,000
Iowa	1,530,581	10,449,403	24,300,000
California	17,328	5,928,470	21,000,000
Ohio	14,487,351	15,119,047	17,550,000
Indiana	6,214,458	16,848,267	17,366,000
Illinois	9,414,575	23,837,023	25,560,000

The wheat production of the three States first named, as shown above, is mainly the growth of the past twenty years; that of Illinois, so rapidly progressive between 1849 and 1859, has made a slow advance since, while the product of Ohio and Indiana, as compared with the advance of population, is an actual reduction, notwithstanding the fact that there are millions of acres in the former State yet in original forest, and in the latter a still larger area, both in forest and prairie, not yet subdued by the plow.

The following statement, furnished by J. M. Shaffer, secretary of the Iowa Agricultural Society, shows the rapidly increasing quantity of surplus wheat shipped (by rail only) from Iowa:

	Bushels.		Bushels.
1865	3,331,769	1867	6,539,628
1866	4,740,440	1868	8,843,162

The reason for this tendency is obvious. The pioneer upon the prairies is a wheat-grower, because wheat is a cash crop, and demands a small outlay of labor; he depends upon its proceeds, not only for a living, but for farm improvements, the purchase of stock and farm implements, and for the erection of a farm-house in place of the log shanty, and for barns and shelters instead of straw-covered sheds and straw stacks. He knows there is danger of reducing the productive value of his land, but its original cost was an insignificant fraction of its intrinsic value, which is more than repaid by the net proceeds of a single crop. He cares little for a small diminution of productive capacity, while he can fence and stock his farm, and place money in bank, from the sale of successive crops of wheat, and then sell the naked land for tenfold its original cost. Immediate returns, with the least labor and capital, are the object of the pioneer. As an expedient, for a poor man, the present practice may be tolerated; as a regular system of farm management, it is reprehensible and ruinous. It will doubtless continue in vogue til our virgin wheat lands are run over by pioneers, who will ultimately be succeeded by scientific farmers who will practice rotation, draining, irrigation, in certain sections, and fertilization from home resources, when the yield will be greatly increased and crops will be surer.

The relative area of wheat must therefore continue its decrease eastward, and its increase westward, till our agriculture changes from its chrysalis state to its development as a complete system. At present our agriculture suffers from want of balance between exhaustive and restorative crops; from an undue preponderance of bread crops, cotton, tobacco, and other products consumed away from the farm and never in any of their elements returned to the soil. Root crops and hay, fed upon the farm, tend to increase the producing capacity and market value of land, and may properly be regarded as restorative crops. Corn, when fed to hogs and cattle on the farm, may perhaps be placed in that category, but a large proportion of the crops sent to domestic or foreign markets, whether for human food or feed for horses or other animals, is utterly lost as a fertilizing agency upon the farm.

The careful observer will find, upon a survey of the statistics of production in different countries, that wherever the balance is in favor of restorative crops, the yield per acre is highest, and *vice versa*. He will almost be inclined to regard the yield as necessarily in proportion to the percentage of area in such crops. The following tabulation presents a fair view of the relative percentage of area in restorative and exhaust-

ive crops in the countries named, and also the average yield of wheat per acre in each of those countries:

Country.	Exhaustive.	Restorative.	Yield of wheat per acre.
	Per cent.	*Per cent.*	*Bushels.*
England	33	67	28
Prussia	45	55	17
France	54	46	14
United States	60	40	12

The English colonies on the Pacific, where land is cheap, follow the exhaustive practice of the United States, rather than the restorative system of the mother country, and the result is shown in a yield of cereals not exceeding our own rate of production.

The influence of the Department of Agriculture has been strongly directed to the conservation and recuperation of all the elements of fertility in our soils, and to the encouragement of restorative processes and systems of cropping. If wheat plantations may still predominate beyond the Mississippi and Missouri, there is no excuse for failing to inaugurate a complete system of American agriculture in Illinois and more eastern States, which shall be self-sustaining and tending constantly to increase of production and profit.

The evil tendency of slip-shod culture and neglect has often been shown in the rapid decrease of yield and reduction in quality. It is not winter wheat alone that is decreasing in value. The deterioration of spring wheat is shown conspicuously by the inspection returns of Milwaukee, from which it appears that four-tenths of the receipts of the past four years have been marked "Number 2;" in 1866 but one-tenth was "Number 1," and more than a fourth "Number 3;" and less than one-half in the four years has been accepted as "Number 1." The statement is as follows:

Crop of—	PER CENT.			
	No. 1.	No. 2.	No. 3.	Rejected.
1868	37.5	59.4	2.4	0.7
1867	60.2	34.3	4.8	0.7
1866	10.8	50.7	28.8	9.7
1865	77.0	15.6	....	7.4

The fault is not inherent either in soil or climate. It is fully accounted for by deficient preparation of the seed bed, rank growth of grass or weeds, and neglect of that systematic variety in cropping necessary for the preservation of a proper equilibrium in the elements entering into the production of wheat.

Quantity required for consumption.—The consumption of wheat is increasing in this country. Formerly, somewhat less than a barrel of flour yearly *per capita* would supply the bread consumption. "Rye and Indian" or "brown bread" in the east, and corn bread in the south, were far more generally used than at present, and constituted the real "staff of life." A barrel of flour at Christmas was the entire wheat supply of the year for a large class of southern white families, while of course the negroes had no flour bread, except a casual crumb from the planter's kitchen. Railroads have had a wonderful influence in equalizing consumption. While, in 1860, the west produced nine and three-fourths

bushels to each inhabitant. New England yielded but eleven quarts to each individual; and yet the traditional brown bread has nearly disappeared from eastern tables, and no difficulty is experienced in obtaining full supplies of flour, since the building of the network of railways connecting nearly every village. Even the larger cities, crowded with tens of thousands of laboring poor, show little if any diminution in consumption of flour during the past three years of high prices. There is another reason for increased consumption in the enlarged facilities for production, by means of machinery, which has superseded at least half of the manual labor formerly required in cultivating, harvesting, and cleaning.

In 1839 the crop was 84,823,272 bushels, or 4.96 to each inhabitant; in 1849, 100,485,944, or 4.33 to each individual; in 1859, 173,104,924 bushels, or 5.50 *per capita*; in 1868, by estimates of this department, 230,000,000 bushels, including Oregon and the territories, which are not found in the tables. As the increase of population was thirty-five per cent. from 1840 to 1850, and also from 1850 to 1860, a similar pro rata increase from 1860 to 1868 would make our population 38,000,000. If the same ratio of increase could be expected through this decade, viz., thirty-five per cent. in population, and twenty-five per cent. in the wheat yield in proportion to population, the crop of 1869 would be 292,000,000 bushels, and that of 1867 should have been more than 260,000,000 bushels. Though far better than the two preceding crops—a fair yield upon a broad area—it probably did not exceed our estimate, 224,036,600 bushels, exclusive of that produced by Oregon and the Territories. Of course there is no expectation of permanency in the rate of increase of the last decade; yet with the prodigality and wastefulness of food for which our people are noted, there is no reason to doubt that we shall attain a consumption at least as large *per capita* as that of Great Britain, viz., six bushels, in addition to the corn which must always constitute an item in our subsistence. The rapid dissemination of reapers and threshers, and the increasing facilities for a general distribution of wheat, are circumstances favoring a lower price and a further advance of the individual rate of consumption. The present increase of wheat-growing in the south is the commencement of a movement which will add materially to the aggregate of future crops; a confident expectation of a home supply of that section is held, but it is neither probable nor desirable that exportation of southern wheat should ever be a prominent interest, other crops, of less bulk and greater value, promising far greater returns. With all this stimulus to enlarged production—the food requirements of a prosperous people, the larger use of flour by the poorer classes, extended facilities for its distribution through districts yielding wheat very sparingly, the greater economy of production by the employment of farm machinery, and the more general growth of this cereal in the distant west, the south, and on the Pacific coast, it would be a short wheat crop in 1869 that should not aggregate 270,000,000 bushels.

CORN.

A disposition was manifested to obtain a large planting of corn in the spring of 1867. The South was anxious to be independent in feed for farm stock and supplies of bread, and put in more of the staple grain than usual. Prices were high in the West, a large meat production was wanted, and farmers were therefore desirous of extending their fields of maize, but their labors encountered many impediments, the principal being a spring so wet as to retard the operations of the plow, and a scarcity of farm laborers.

The cold rains also caused slow growth and an unpromising appearance until the summer was somewhat advanced, when a serious drought set in, which continued until the season of ripening, resulting in a loss of one-third of the expected crop in the principal corn-growing section of the Union—the Ohio valley. The aggregate yield of the year was less by 250,000,000 bushels than should have been reasonably expected as a good crop: the revised estimates showing but 768,000,000 bushels, against 838,000,000 in 1859, when 1,000,000,000 are required for consumption, export, and a reserved stock.

In 1868, the necessity for a determined effort to make good the deficiency of corn was apparent to all. Returns of estimates of acreage showed an increase of more than two millions of acres, or about seven per cent. A large proportion of this advance was in the southern States, indicative of an apparent intention to make that section self-supporting, and its cotton strictly a surplus product. The following is a statement of the estimated increase or decrease of acreage in the several States:

State.	ACRES.	
	Increase.	Decrease.
Maine	6,200	
New Hampshire		2,768
Vermont	1,440	
Massachusetts		4,245
Rhode Island	1,363	
Connecticut		4,645
New York	11,990	
New Jersey		21,531
Pennsylvania		38,096
Delaware		92,251
Maryland	35,691	
Virginia	[illegible]	
North Carolina	84,504	
South Carolina	[illegible]	
Georgia		67,431
Florida	[illegible]	
Alabama	701,234	
Mississippi	[illegible]	
Louisiana	179,555	
Texas	118,871	
Arkansas	262,279	
Tennessee	44,648	
West Virginia	1,002	
Kentucky		[illegible]
Missouri	[illegible]	
Illinois		[illegible]
Indiana		[illegible]
Ohio		52,31
Michigan	[illegible]	
Wisconsin	[illegible]	
Minnesota	96,417	
Iowa	[illegible]	
Kansas	149,015	
Nebraska	74,499	
California		

The high temperature of July was favorable to the growth of corn, which is generally grown upon deep, rich bottoms; and the prospect was good for a thousand million bushels until August, when unseasonably cool, and, in some localities, wet weather set in, followed by early frosts. The result was a sudden and an injurious check at the critical period of earing, resulting in late ripening, smut, and other evidences of abnormal conditions.

While the early summer was excessively warm, few localities suffered from drought; showers were sufficiently frequent, as a rule, and the heated term was not of long continuance. In August the rain-fall became injurious, and much damage to corn was reported in southern Indi-

ana, southern Ohio, West Virginia, and Pennsylvania. The injury from early frosts was heavy in northern Indiana, northern Illinois, and Iowa. Many local reports contained estimates of forty per cent. of soft corn in consequence.

These causes reduced the aggregate yield at least one hundred millions. The final estimate is in round numbers nine hundred millions of bushels.

COTTON.

A reduction in the acreage of cotton is noted in every State except Texas, in which the increase appears to be about thirty per cent. The decrease, as compared with the previous year, is estimated at twenty-four per cent. in Louisiana, eighteen in Mississippi, thirteen in Arkansas, twenty in Tennessee, twelve in Georgia, eighteen in South Carolina, and thirty-two in North Carolina. The returns of diminished acreage in early summer did not excite apprehensions of a decrease in the crop of the year. On the contrary, a reasonable expectation was held of a return at least equal to that of 1867. This confidence grew out of the fact that cleaner and better culture was attained, and in the Atlantic States a larger amount of fertilizers was used, while a steady improvement in the quality of labor was realized.

A lack of rain in the Gulf States gave rise to apprehensions of loss, and a pretty severe drought prevailed in Tennessee; but the cotton plant, if in good soil, thoroughly cultivated, can only be injured by excessive drought, and it may well be doubted whether the high temperature and continued sunshine accomplished as much of injury as they effected development and perfection of the bolls, and ultimate increase of the crop.

Fewer drawbacks than usual were reported. In parts of Georgia the continued dry weather (for ten weeks in May, June, and July) was to some extent prejudicial. The cotton caterpillar destroyed a portion of the sea-island cotton. The boll worm appeared in some places to a limited extent.

The autumn was remarkably favorable, both for ripening and picking; frosts came late, and the weather as a rule continued dry and pleasant. The mean temperature of Mississippi was 64° in October and 51° in November: in Texas, 69° in October and 57° in November. The aggregate crop of the year was estimated in October at two million three hundred and eighty thousand bales.

The most egregious misstatements are regularly made by the bulls and bears of the cotton markets, prior to the season of picking, concerning the probable yield of the year. Estimates will inevitably appear in business letters and circulars, and in the news journals of the day: and it is of the utmost importance that judicious estimates should be made and published long before the actual receipts can be footed up. The Department of Agriculture, having the best facilities for an accurate estimate of the coming crop, has issued, each October for three years past, at the very commencement of the cotton harvest, bulletins estimating the probable production. The first estimate was of the crop of 1866: and while another department of the government, coinciding with the views of the planters themselves, placed it at 1,200,000 bales, our figures were 1,835,000 bales. The actual receipts up to the following September showed that the crop of 1866, after deducting the cotton of previous years, brought forth from the hiding places of the war, was

about 1,900,000 bales. The estimates of 1867 and 1868 were respectively 2,340,000 bales and 2,380,000 bales. In every instance the estimate has come within 50,000 to 150,000 bales of the result as known ten months afterwards.*

The manufacture of cotton in the United States is steadily increasing. The rate of its increase is indicated by the following figures:

	Pounds.
Cotton manufactured in 1791	5,500,000
Cotton manufactured in 1801	9,000,000
Cotton manufactured in 1811	17,000,000
Cotton manufactured in 1821	50,000,000
Cotton manufactured in 1831	77,500,000
Cotton manufactured in 1841	97,500,000
Cotton manufactured in 1850	245,250,000
Cotton manufactured in 1860	422,704,975

Returns made to the National Association of Cotton Manufacturers and Planters, to the date January 30, 1869, place the consumption of seven hundred and fifty mills at 417,367,771 pounds. The eighty-one known mills not reporting are estimated to require 27,960,000 pounds. With 24,672,229 pounds used for textile fabrics and batting, the aggregate required per annum is 470,000,000. Allowing for possible exaggeration, the total consumption is assumed to be 450,000,000 pounds. Of the seven hundred and fifty mills reported, eighty-six are in the southern States, running 225,063 spindles, consuming 31,415,750 pounds. The following table presents, in condensed form, the substance of these returns:

State.	Mills.	Spindles.	Average yarn.	Cotton spun.	Average per spindle.
			Number.	*Pounds.*	*Pounds.*
Maine	22	443, 800	24⅞	28, 838, 608	65. 00
New Hampshire	49	734, 460	25⅜	48, 089, 439	65. 46
Vermont	16	28, 038	29½	1, 281, 125	45. 69
Massachusetts	150	2, 386, 002	27⅓	138, 081, 144	57. 87
Rhode Island	126	1, 082, 376	35¼	51, 938, 373	47. 06
Connecticut	81	545, 528	29	31, 652, 920	58. 00
New York	88	437, 482	32⅕	22, 097, 044	50. 51
New Jersey	30	175, 042	32⅗	10, 767, 650	61. 51
Pennsylvania	71	384, 828	17	34, 806, 531	90. 45
Delaware	9	48, 892	21	3, 288, 289	67. 46
Maryland	11	45, 502	12⅝	7, 972, 896	175. 22
Ohio	5	22, 834	13	3, 170, 000	138. 82
Indiana	1	10, 800	14	1, 493, 061	138. 26
Illinois	1	....	....	....	....
Missouri	4	13, 436	10	2, 475, 000	184. 21
Virginia	10	36, 060	15⅞	4, 010, 000	111. 18
North Carolina	17	24, 249	10½	3, 537, 000	145. 85
South Carolina	5	31, 588	13⅝	4, 174, 100	132. 14
Georgia	20	69, 782	12⅜	10, 864, 350	155. 70
Alabama	8	25, 196	17	2, 820, 596	112. 00
Mississippi	6	8, 752	9	1, 457, 000	166. 48
Texas	4	8, 528	9½	1, 372, 104	160. 90
Arkansas	2	924	8⅓	258, 400	268. 83
Tennessee	10	13, 720	10	1, 847, 200	134. 00
Kentucky	3	6, 264	10	1, 075, 000	171. 62

* The supplementary report of the honorary commissioner at the Paris Exposition recently issued by the State Department uses the following language:

"It is much to be desired that the Statistical Bureau, established at Washington, shall prepare and publish, periodically, full and reliable statistics concerning all the important branches of business in this country, similar to those issued by the British Board of Trade; and it is equally to be desired, for the credit and business interests of the country, that the Agricultural Bureau shall issue accurate statistics in place of its *estimates* of the cotton crop, which, from their supposed official character, have obtained credence, while erroneous beyond excuse, to the extent of about 300,000 bales in the statement of production of each of the last three crops."

As the estimate of this department for the last of the "last three" crops was 2,380,000

The increase in the manufacture of cotton in Europe has also been steady. From 1835 to 1840 the quantity used in Great Britain was less per annum than for a similar period commencing with 1862, the year of greatest scarcity, not reaching a million bales, while the annual average for the latter period of five years was 1,298,417 bales of 400 pounds each. The average for the period of five years commencing with 1856, the era of unexampled production of cotton goods, was 2,397,647 bales, or 959,058,800 pounds. The falling off in consumption of raw cotton, therefore, during the scarcity of American cotton was forty-five per cent. The present requirements of the manufacture are fully up to the average of 1856-'61, or about 2,400,000 bales of 400 pounds each, while the continent of Europe and the United States require 2,600,000, or 5,000,000 bales in all. Of this supply of the spindles of Europe and America this country takes one-fifth, the proportion attained prior to 1860, and very nearly the same quantity. Were prices of cotton lower, a still larger quantity might safely be placed upon the markets of the world, as the consumption of cotton goods tends constantly to increase.

The following table presents a condensed view of the exports of American cotton during the past forty-three years. It makes an aggregate of 26,464,000,000 of pounds, and the exports prior to 1825 would bring the total contribution of America to the factories of Europe up to about 28,500,000,000 pounds.

Statement showing the actual exports of cotton, as officially reported, from 1826 to 1868, inclusive.

	Sea Island cotton.	Upland cotton.	Value of cotton—exports.	Value of cotton—manufactures exported.
	Pounds.	*Pounds.*		
Five years ending 1830	[illegible]	1,219,349,740	$133,122,182	$5,885,402
Five years ending 1835	[illegible]	1,651,933,614	207,614,983	9,833,079
Five years ending 1840	[illegible]	2,586,355,611	321,191,127	15,370,602
Five years ending 1845	[illegible]	3,407,262,371	256,846,555	16,543,492
Five years ending 1850	[illegible]	3,507,423,941	296,563,066	23,013,762
Five years ending 1855	54,747,909	5,073,547,[illegible]	491,169,517	35,065,947
Total, 30 years	267,279,727	17,445,873,173	1,796,507,430	105,712,284
1856	[illegible]	1,[illegible],634,476	128,382,351	6,967,309
1857	[illegible]	1,035,341,750	131,575,859	6,115,177
1858	[illegible]	1,106,522,954	131,386,661	5,651,504
1859	13,713,556	1,372,755,006	161,434,923	8,316,222
1860	[illegible]	1,752,087,640	191,806,555	10,934,796
1861	6,170,321	301,345,778	34,051,483	10,957,038
1862	[illegible]	4,998,121	1,180,113	2,937,464
1863	527,747	10,857,239	6,652,405	2,906,411
1864	[illegible]	11,860,390	9,895,854	1,456,901
1865	[illegible]	6,276,582	5,720,549	3,331,582
1866	7,284,473	643,288,356	[illegible]	1,780,175
1867	6,742,314	654,731,274	201,470,423	4,[illegible],217
1868	[illegible]	779,765,318	152,820,733	4,871,054
Total, 13 years	93,403,980	[illegible]	1,437,763,132	76,833,850
Total, 43 years	[illegible]	26,464,338,057	3,144,270,562	182,546,134

bales, and as scarcely half had been delivered at the date of this report, the assumption of an underestimate of 300,000 bales was as unwarrantable as it has proved erroneous. The estimate of 1867 was 2,340,000, while the Commissioner places the yield at 2,500,241, which is a greater error than the estimate. He declares the crop of 1865 to have been 2,241,116, when every one at all acquainted with the history of that crop is well aware that a large proportion of this aggregate of receipts was grown in previous years, and that the planting season in the very midst of the expiring throes of the war was generally disregarded or utterly ignored. His error mainly consists in not discriminating between the crop of a given year and the cotton movement of the commercial year. He takes no account of the old cotton in the hands of planters. *His attention is respectfully called to a single instance—a sale of 600 bales, the present year, grown during the war!*

CROPS OF 186[illegible].

Table showing the amount in bushels, &c., of each principal crop of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop for 186[illegible].

Product.	Amount of crop of 186[illegible].	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
MAINE.					
Indian corn.........bushels..	1,590,000	23.8	[illegible]	$1 38	$2,194,200
Wheat.........do....	168,000	[illegible]	[illegible]	2 40	403,200
Rye.........do....	14[illegible]	[illegible]	9,666	1 61	233,450
Oats.........do....	[illegible]	[illegible]	[illegible]	82	1,526,840
Barley.........do....	[illegible]	16.1	[illegible]	1 [illegible]	705,600
Buckwheat.........do....	[illegible]	[illegible]	15,130	[illegible]	334,[illegible]
Potatoes.........do....	5,500,000	130	42,307	78	4,290,000
Tobacco.........pounds..	....	....	....	....	....
Hay.........tons..	1,2[illegible]	[illegible]	1,203,921	12 00	14,736,000
Total.........	....	....	1,460,597	....	24,423,370
NEW HAMPSHIRE.					
Indian corn.........bushels..	[illegible]	[illegible]	43,171	$1 43	$2,160,730
Wheat.........do....	[illegible]	11.7	[illegible]	2 42	621,940
Rye.........do....	[illegible]	12.[illegible]	10,625	1 [illegible]	214,880
Oats.........do....	1,232,000	26.5	[illegible]	76	936,320
Barley.........do....	[illegible]	[illegible]	3,703	1 47	117,600
Buckwheat.........do....	78,[illegible]	[illegible]	[illegible]	[illegible]	72,540
Potatoes.........do....	3,950,000	132	29,924	71	2,804,500
Tobacco.........pounds..	....	....	....	....	....
Hay.........tons..	917,[illegible]	1	917,000	13 50	12,379,500
Total.........	....	....	[illegible]	....	19,308,010
VERMONT.					
Indian corn.........bushels..	1,672,[illegible]	[illegible]	43,423	$1 34	$2,240,480
Wheat.........do....	714,000	.16	[illegible]	2 [illegible]	1,613,640
Rye.........do....	141,000	14.8	9,527	1 43	201,630
Oats.........do....	[illegible]	30	[illegible]	75	3,041,250
Barley.........do....	91,000	23	3,956	1 44	131,040
Buckwheat.........do....	168,000	14	[illegible]	[illegible]	161,280
Potatoes.........do....	[illegible]	135	35,555	60	2,880,000
Tobacco.........pounds..	....	....	....	....	....
Hay.........tons..	1,010,000	[illegible]	990,196	14 50	14,645,000
Total.........	....	....	[illegible]	....	24,914,320
MASSACHUSETTS.					
Indian corn.........bushels..	[illegible]	37	61,945	$1 32	[illegible]
Wheat.........do....	166,000	15.5	[illegible]	2 40	[illegible]
Rye.........do....	[illegible]	16.1	27,639	[illegible]	[illegible]
Oats.........do....	1,261,000	[illegible]	52,323	[illegible]	1,134,900
Barley.........do....	138,000	20.1	6,865	[illegible]	215,280
Buckwheat.........do....	73,000	13.2	[illegible]	[illegible]	78,840
Potatoes.........do....	[illegible]	116	34,913	[illegible]	3,766,500
Tobacco.........pounds..	4,161,000	1300	3,200	23	957,030
Hay.........tons..	[illegible]	1.37	[illegible]	[illegible]	22,172,590
Total.........	....	....	[illegible]	....	[illegible]
RHODE ISLAND.					
Indian corn.........bushels..	[illegible]	27	17,592	$1 65	[illegible]
Wheat.........do....	[illegible]	14.3	601	[illegible]	[illegible]
Rye.........do....	31,000	16.6	[illegible]	[illegible]	[illegible]
Oats.........do....	[illegible]	[illegible]	[illegible]	77	154,000
Barley.........do....	[illegible]	[illegible]	[illegible]	1 60	[illegible]
Buckwheat.........do....	3,100	17	182	1 17	3,627
Potatoes.........do....	[illegible]	101	[illegible]	[illegible]	[illegible]
Tobacco.........pounds..	....	....	....	....	....
Hay.........tons..	[illegible]	1.18	[illegible]	[illegible]	1,420,000
Total.........	....	....	[illegible]	....	3,206,647
CONNECTICUT.					
Indian corn.........bushels..	2,152,000	[illegible]	[illegible]	[illegible]	$2,905,200
Wheat.........do....	73,[illegible]	15.5	[illegible]	2 00	146,000
Rye.........do....	[illegible]	14.5	[illegible]	1 48	1,238,760
Oats.........do....	[illegible]	27.7	[illegible]	[illegible]	2,218,100
Barley.........do....	[illegible]	20	[illegible]	1 26	21,420
Buckwheat.........do....	200,000	18.2	[illegible]	1 [illegible]	240,000
Potatoes.........do....	1,750,000	117	14,957	91	1,592,500

Table showing the amount in bushels, &c., of each principal crop, &c.—Continued.

Product.	Amount of crop of 1868.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
CONNECTICUT—Continued.					
Tobacco ....pounds..	7,063,000	1450	4,871	$0 25	$1,765,750
Hay ....tons..	883,000	1.15	767,826	17 25	15,231,750
Total....................	....	....	1,022,873	....	25,359,450
NEW YORK.					
Indian corn....................bushels..	20,910,000	32	653,437	$1 12	$23,419,200
Wheat ....do....	8,497,000	14.6	581,986	2 08	17,673,760
Rye....................do....	4,845,000	15.1	320,861	1 37	6,637,650
Oats ....do....	25,000,000	26	961,538	74	18,500,000
Barley ....do....	3,840,000	21.4	179,439	1 78	6,835,200
Buckwheat ....do....	5,886,000	19.7	298,781	1 01	5,944,860
Potatoes....................do....	25,340,000	94	269,574	76	19,258,400
Tobacco....................pounds..	12,000,000	800	15,000	12.5	1,500,000
Hay....................tons..	4,500,000	1	4,500,000	15 00	67,500,000
Total....................	....	....	7,780,615	....	167,269,070
NEW JERSEY.					
Indian corn ....bushels..	10,216,000	37.5	272,426	$0 99	$10,113,840
Wheat....................do....	1,432,000	13.9	103,021	2 11	3,021,520
Rye ....do....	1,358,000	13.5	100,592	1 50	2,037,000
Oats ....do....	5,368,000	22.4	239,642	69	3,703,920
Barley....................do....	26,000	22.9	1,135	1 55	40,300
Buckwheat....................do....	852,000	16.7	51,017	1 28	1,090,560
Potatoes ....do....	3,670,000	97	37,835	97	3,559,900
Tobacco....................pounds..	150,000	700	214	10.5	15,750
Hay....................tons..	486,000	1.40	347,142	19 00	9,234,000
Total....................	....	....	1,153,024	....	32,816,790
PENNSYLVANIA.					
Indian corn....................bushels..	31,979,000	35	913,685	$1 00	$31,979,000
Wheat ....do....	15,300,000	12.8	1,195,312	1 98	30,294,000
Rye ....do....	6,558,000	13.2	496,818	1 32	8,656,560
Oats....................do....	55,108,000	27.8	1,982,302	64	35,269,120
Barley ....do....	590,000	21.4	27,570	1 64	967,600
Buckwheat ....do....	8,224,000	16.5	498,424	1 09	8,964,160
Potatoes ....do....	11,852,000	88	134,681	93	11,022,360
Tobacco....................pounds..	4,617,000	825	5,596	08	369,360
Hay ....tons..	2,448,000	1.35	1,813,333	16 00	39,168,000
Total....................	....	....	7,067,721	....	166,691,160
DELAWARE.					
Indian corn....................bushels..	3,275,000	25	131,000	$0 85	$2,783,750
Wheat ....do....	691,000	12	57,583	1 90	1,312,900
Rye....................do....	32,000	6.7	4,776	1 40	44,800
Oats ....do....	1,436,000	8	179,500	60	861,600
Barley....................do....	5,000	24	208	1 22	6,100
Buckwheat ....do....	22,000	20	1,100	1 25	27,500
Potatoes ....do....	345,000	75	4,600	1 00	345,000
Tobacco....................pounds.	12,000	600	20	09	1,080
Hay....................tons..	33,000	1.25	26,400	20 00	660,000
Total....................	....	....	405,187	....	6,043,730
MARYLAND.					
Indian corn....................bushels..	12,349,000	27.7	445,812	$0 87	$10,743,630
Wheat ....do....	5,706,000	10.2	559,411	2 09	11,925,540
Rye ....do....	503,000	12.1	41,570	1 35	679,050
Oats....................do...	6,096,000	18	338,666	64	3,901,440
Barley ....do....	23,000	23.5	978	1 22	28,060
Buckwheat....................do....	188,000	18.7	10,053	1 20	225,600
Potatoes ....do....	1,205,000	94	12,819	93	1,120,650
Tobacco....................pounds..	16,404,000	560	29,292	10.8	1,771,632
Hay....................tons..	219,000	1.28	171,093	16 77	3,672,630
Total....................	....	....	1,609,694	....	34,068,232
VIRGINIA.					
Indian corn....................bushels..	19,969,000	19.3	1,034,663	$0 76	$15,176,440
Wheat ....do...	6,914,000	8.4	823,095	1 90	13,136,600
Rye ....do....	760,000	8.3	91,566	1 18	896,800
Oats ....do...	8,671,000	17.8	487,134	54	4,682,340
Barley ....do...	5,000	15	333	1 00	5,000
Buckwheat....................do...	157,000	18.4	8,532	98	153,860
Potatoes ....do....	1,350,000	74	18,243	74	999,000

Table showing the amount in bushels, &c., of each principal crop, &c.—Continued.

Product.	Amount of crop of 1868.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
VIRGINIA—Continued.					
Tobacco .... pounds..	93,600,000	793	119,540	$0 8.5	$7,956,000
Hay .... tons..	[illegible]	1.22	185,245	13 00	2,938,000
Total	....	....	2,768,351	....	45,944,040
NORTH CAROLINA.					
Indian corn .... bushels..	[illegible]	14.3	[illegible]	$0 78	[illegible]
Wheat .... do....	[illegible]	5.9	[illegible]	[illegible]	5,942,000
Rye .... do....	[illegible]	7.4	52,567	1 29	501,810
Oats .... do....	3,479,000	13	267,615	65	2,261,350
Barley .... do....	3,100	15.6	[illegible]	1 25	3,875
Buckwheat .... do....	23,000	15.6	1,474	83	[illegible]
Potatoes .... do....	[illegible]	76	[illegible]	89	745,820
Tobacco .... pounds..	41,016,000	657	[illegible]	[illegible]	6,849,672
Hay .... tons..	[illegible]	1.25	[illegible]	15 00	[illegible]
Total	....	....	[illegible]	....	37,339,097
SOUTH CAROLINA.					
Indian corn .... bushels..	9,870,000	10.2	967,647	$1 00	$9,870,000
Wheat .... do....	[illegible]	5.6	128,035	2 25	1,613,250
Rye .... do....	[illegible]	5	10,800	1 58	85,320
Oats .... do....	[illegible]	9.7	64,845	85	534,650
Barley .... do....	7,400	9	822	1 90	14,060
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	150,000	101	1,485	1 55	232,500
Tobacco .... pounds..	[illegible]	500	204	17	17,340
Hay .... tons..	86,000	0.95	90,526	[illegible]	1,462,000
Total	....	....	1,264,364	....	13,829,120
GEORGIA.					
Indian corn .... bushels..	[illegible]	12.7	2,149,133	$0 91	$24,837,540
Wheat .... do....	[illegible]	5.6	[illegible]	2 20	4,030,400
Rye .... do....	[illegible]	6.9	[illegible]	1 70	119,000
Oats .... do....	[illegible]	12.5	[illegible]	79	894,280
Barley .... do....	[illegible]	15.5	761	2 15	25,370
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	[illegible]	102	3,117	1 48	[illegible]
Tobacco .... pounds..	[illegible]	585	2,071	[illegible]	[illegible]
Hay .... tons..	61,000	1	61,000	[illegible]	1,335,900
Total	....	....	[illegible]	....	[illegible]
FLORIDA.					
Indian corn .... bushels..	[illegible]	10.5	[illegible]	[illegible]	$4,159,500
Wheat .... do....	1,000	9	111	2 75	2,750
Rye .... do....	9,000	10	900	1 75	15,750
Oats .... do....	13,800	11.5	1,200	1 00	13,800
Barley .... do....	3,000	14.3	209	2 00	6,000
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	18,000	110	163	1 70	30,600
Tobacco .... pounds..	480,000	500	945	28	134,400
Hay .... tons..	8,500	1	8,500	21 00	178,500
Total	....	....	292,940	....	4,541,300
ALABAMA.					
Indian corn .... bushels..	31,240,000	10.8	2,892,592	$0 86	$26,866,400
Wheat .... do....	829,000	6.1	135,901	1 98	1,641,420
Rye .... do....	39,000	5.8	6,724	1 69	65,910
Oats .... do....	567,000	11.7	48,461	88	498,960
Barley .... do....	8,000	10.1	792	1 83	14,640
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	340,000	61	5,573	1 51	513,400
Tobacco .... pounds..	340,000	566	600	28	95,200
Hay .... tons..	85,000	1.66	51,204	19 28	1,638,800
Total	....	....	3,141,847	....	31,334,750
MISSISSIPPI.					
Indian corn .... bushels..	35,519,000	17.1	2,077,134	$0 71	[illegible]
Wheat .... do....	242,000	9.1	26,593	2 19	[illegible]
Rye .... do....	21,000	10.5	2,000	1 97	41,370
Oats .... do....	110,000	15.3	7,189	1 01	111,100
Barley .... do....	8,100	10	810	1 40	11,340
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	442,000	65	6,800	1 45	640,900

[illegible]—Continued.

Product.	[illegible]	[illegible]	[illegible]	[illegible]	Total valuation.
MISSISSIPPI—Continued.					
Tobacco ... pounds..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hay ... tons.	[illegible]	1.25	[illegible]	[illegible]	[illegible]
Total	....	......	[illegible]	......	[illegible]
LOUISIANA.					
Indian corn ... bushels..	[illegible]	[illegible]	[illegible]	[illegible]	$[illegible]
Wheat ... do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rye ... do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oats ... do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Barley ... do....	....	......	....	......	....
Buckwheat ... do....	....	......	....	......	....
Potatoes ... do....	[illegible]	[illegible]	[illegible]	1 7[illegible]	[illegible]
Tobacco ... pounds..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hay ... tons..	[illegible]	2	[illegible]	[illegible]	[illegible]
Total	....	......	[illegible]	......	14,[illegible]
TEXAS.					
Indian corn ... bushels..	21,[illegible]	[illegible]	[illegible]	$0 [illegible]	16,[illegible]
Wheat ... do....	[illegible]	[illegible]	[illegible]	2 [illegible]	[illegible]
Rye ... do....	[illegible]	11.[illegible]	[illegible]	1 [illegible]	147,[illegible]
Oats ... do....	[illegible]	[illegible]	[illegible]	[illegible]	774,[illegible]
Barley ... do....	33,[illegible]	11	3,[illegible]	2 1[illegible]	71,[illegible]
Buckwheat ... do....	....	......	....	......	....
Potatoes ... do....	[illegible]	[illegible]	[illegible]	1 [illegible]	[illegible]
Tobacco ... pounds..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hay ... tons..	[illegible]	[illegible]	[illegible]	10 00	173,[illegible]
Total	....	......	[illegible]	......	15,[illegible]
ARKANSAS.					
Indian corn ... bushels..	32,440,[illegible]	30.[illegible]	1,[illegible]	$[illegible]	$21,44[illegible]
Wheat ... do....	1,[illegible]	1[illegible]	[illegible]	2 [illegible]	2,[illegible]
Rye ... do....	[illegible]	1[illegible]	2,[illegible]	1 [illegible]	41,[illegible]
Oats ... do....	45[illegible]	25.[illegible]	[illegible]	[illegible]	351,[illegible]
Barley ... do....	4,[illegible]	11	[illegible]	2 10	8,4[illegible]
Buckwheat ... do....	....	......	....	......	....
Potatoes ... do....	[illegible]	[illegible]	[illegible]	1 [illegible]	462,[illegible]
Tobacco ... pounds..	2,5[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hay ... tons..	[illegible]	1.25	[illegible]	10 00	15[illegible]
Total	....	......	1,1[illegible]	......	[illegible]
TENNESSEE.					
Indian corn ... bushels..	54,772,[illegible]	2[illegible]	2,[illegible]	$0 4[illegible]	$[illegible]
Wheat ... do....	[illegible]	[illegible]	[illegible]	1 [illegible]	[illegible]
Rye ... do....	[illegible]	9	[illegible]	1 25	[illegible]
Oats ... do....	[illegible]	15.4	[illegible]	[illegible]	1,[illegible]
Barley ... do....	[illegible]	[illegible]	[illegible]	1 4[illegible]	[illegible]
Buckwheat ... do....	[illegible]	11.[illegible]	[illegible]	1 [illegible]	14,[illegible]
Potatoes ... do....	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tobacco ... pounds..	[illegible]	[illegible]	4[illegible]	[illegible]	[illegible]
Hay ... tons..	[illegible]	1.25	[illegible]	[illegible]	[illegible]
Total	....	......	[illegible]	......	5[illegible]
WEST VIRGINIA.					
Indian corn ... bushels..	7,[illegible]	[illegible]	[illegible]	$0 [illegible]	$5,771,[illegible]
Wheat ... do....	[illegible]	[illegible]	[illegible]	1 [illegible]	4,[illegible]
Rye ... do....	[illegible]	[illegible]	[illegible]	1 [illegible]	[illegible]
Oats ... do....	1,[illegible]	24.7	[illegible]	[illegible]	[illegible]
Barley ... do....	[illegible]	[illegible]	[illegible]	1 [illegible]	[illegible]
Buckwheat ... do....	[illegible]	[illegible]	[illegible]	1 [illegible]	[illegible]
Potatoes ... do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tobacco ... pounds..	[illegible]	[illegible]	[illegible]	17	[illegible]
Hay ... tons..	[illegible]	1.25	[illegible]	[illegible]	2,[illegible]
Total	....	......	[illegible]	......	14,[illegible]
KENTUCKY.					
Indian corn ... bushels..	5[illegible]	32.7	1,7[illegible]	$0 47	$27,347,[illegible]
Wheat ... do....	[illegible]	8.5	[illegible]	1 [illegible]	5,301,000
Rye ... do....	4[illegible]	11.5	41,478	1 [illegible]	[illegible]
Oats ... do....	5,[illegible]	[illegible]	[illegible]	[illegible]	2,834,880
Barley ... do....	[illegible]	16	9,312	1 67	[illegible]
Buckwheat ... do....	11,600	[illegible]	[illegible]	1 23	14,2[illegible]
Potatoes ... do....	2,[illegible]	[illegible]	[illegible]	67	1,407,000

Table showing the amount in bushels, &c., of each principal crop, &c.—Continued.

Product.	Amount of crop of 1862.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
KENTUCKY—Continued.					
Tobacco..........pounds..	46, 400, 000	705	65, 815	$0 12.7	$5, 892, 800
Hay..........tons..	128, 000	1. 27	100, 787	13 25	1, 696, 000
Total..........	....	....	2, 627, 581	....	45, 324, 608
MISSOURI.					
Indian corn..........bushels..	60, 967, 000	30. 3	2, 012, 112	$0 57	$34, 751, 190
Wheat..........do....	5, 357, 000	14	382, 642	1 49	7, 981, 930
Rye..........do....	269, 000	18. 5	14, 540	96	258, 240
Oats..........do....	4, 529, 000	32. 9	137, 659	43	1, 947, 470
Barley..........do....	166, 000	24. 2	6, 859	1 74	288, 840
Buckwheat..........do....	64, 000	17. 3	3, 699	1 03	65, 920
Potatoes..........do....	1, 040, 000	90	11, 555	90	936, 000
Tobacco..........pounds..	10, 957, 000	796	13, 765	11.3	1, 238, 141
Hay..........tons..	652, 000	1. 40	465, 714	11 00	7, 172, 000
Total..........	....	....	3, 048, 545	....	54, 639, 731
ILLINOIS.					
Indian corn..........bushels..	134, 363, 000	34. 2	3, 928, 742	$0 43	$57, 776, 090
Wheat..........do....	28, 560, 000	11. 5	2, 483, 478	1 20	34, 272, 000
Rye..........do....	645, 000	16. 2	39, 814	93	599, 850
Oats..........do....	32, 479, 000	31. 9	1, 018, 150	39	12, 666, 810
Barley..........do....	976, 000	25. 8	37, 829	1 36	1, 327, 360
Buckwheat..........do....	198, 000	16. 6	11, 927	1 07	211, 860
Potatoes..........do....	3, 800, 000	71	53, 521	81	3, 078, 000
Tobacco..........pounds..	15, 160, 000	757	20, 026	09.1	1, 379, 560
Hay..........tons..	2, 667, 000	1. 40	1, 905, 000	10 00	26, 670, 000
Total..........	....	....	9, 498, 487	....	137, 981, 530
INDIANA.					
Indian corn..........bushels..	90, 832, 000	34	2, 671, 529	$0 52	$47, 232, 640
Wheat..........do....	17, 366, 000	11. 2	1, 550, 535	1 50	26, 049, 000
Rye..........do....	423, 000	14. 9	28, 389	1 06	448, 380
Oats..........do....	11, 285, 000	26. 5	425, 849	46	5, 191, 100
Barley..........do....	335, 000	20. 5	16, 341	1 57	525, 950
Buckwheat..........do....	370, 000	19. 3	19, 170	95	351, 500
Potatoes..........do....	3, 100, 000	88	35, 227	75	2, 325, 000
Tobacco..........pounds..	7, 237, 000	705	10, 265	10.5	759, 885
Hay..........tons..	1, 280, 000	1. 35	948, 148	11 09	14, 195, 200
Total..........	....	....	5, 705, 453	....	97, 078, 655
OHIO.					
Indian corn..........bushels..	74, 040, 000	34	2, 177, 647	$0 60	$44, 424, 000
Wheat..........do....	17, 050, 000	13	1, 311, 538	1 65	28, 132, 500
Rye..........do....	1, 104, 000	13. 6	81, 176	1 14	1, 258, 560
Oats..........do....	24, 227, 000	29	835, 413	50	12, 113, 500
Barley..........do....	2, 343, 000	22. 5	104, 133	1 47	3, 444, 210
Buckwheat..........do....	992, 000	17. 3	57, 341	1 07	1, 061, 440
Potatoes..........do....	7, 200, 000	79	91, 139	84	6, 048, 000
Tobacco..........pounds..	11, 000, 000	814	13, 513	07.6	836, 000
Hay..........tons..	2, 030, 000	1. 30	1, 561, 538	13 80	28, 014, 000
Total..........	....	....	6, 233, 438	....	125, 332, 210
MICHIGAN.					
Indian corn..........bushels..	18, 815, 000	33	570, 151	$0 76	$14, 299, 400
Wheat..........do....	16, 012, 000	12. 5	1, 280, 960	1 64	26, 259, 680
Rye..........do....	606, 000	18. 1	33, 480	1 09	660, 540
Oats..........do....	7, 562, 000	30. 1	251, 229	50	3, 781, 000
Barley..........do....	430, 000	23. 3	18, 454	1 56	670, 800
Buckwheat..........do....	1, 267, 000	19. 4	65, 309	82	1, 038, 940
Potatoes..........do....	5, 650, 000	94	60, 106	56	3, 164, 000
Tobacco..........pounds..	3, 430, 000	1100	3, 118	21	720, 300
Hay..........tons..	1, 473, 000	1. 25	1, 178, 400	15 00	22, 095, 000
Total..........	....	....	3, 461, 207	....	72, 689, 660
WISCONSIN.					
Indian corn..........bushels..	12, 565, 000	33	380, 757	$0 58	$7, 287, 700
Wheat..........do....	22, 660, 000	13	1, 743, 076	1 00	22, 660, 000
Rye..........do....	1, 018, 000	18. 6	54, 731	90	916, 200
Oats..........do....	18, 753, 000	32	586, 031	49	9, 188, 970
Barley..........do....	885, 000	24	36, 875	1 35	1, 194, 750
Buckwheat..........do....	57, 000	18. 5	3, 081	81	46, 170
Potatoes..........do....	3, 900, 000	77	50, 649	72	2, 808, 000

Table showing the amount in bushels, &c., of each principal crop, &c.—Continued.

Product.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
WISCONSIN—Continued.					
Tobacco .... pounds..	[illegible]	750	101	$0 20	$15, 2[illegible]
Hay .... tons..	1, 274, [illegible]	1. 20	1, 061, 656	[illegible]	[illegible]
Total	....	....	3, [illegible]	....	[illegible]
MINNESOTA.					
Indian corn .... bushels..	8, 255, 000	33. 5	[illegible], 417	[illegible]	$[illegible], 2[illegible]
Wheat .... do....	14, [illegible]	15	[illegible]	83	12, [illegible]
Rye .... do....	[illegible]	20. 6	25, 485	[illegible]	[illegible]
Oats .... do....	7, 011, 000	36	194, 750	48	3, [illegible]
Barley .... do...	[illegible]	[illegible]	16, 240	1 14	[illegible]
Buckwheat .... do....	44, 000	19. 4	2, 268	[illegible]	[illegible]
Potatoes .... do....	3, 250, 000	151	21, 523	61	1, [illegible]
Tobacco .... pounds..	76, 000	700	[illegible]	[illegible]	[illegible]
Hay .... tons..	582, 000	1. 40	[illegible], 714	7 [illegible]	4, [illegible]
Total	....	....	1, [illegible], 171	....	[illegible]
IOWA.					
Indian corn .... bushels..	[illegible]	37	1, 765, 729	$0 37	$24, 172, 840
Wheat .... do....	20, 300, 000	14. 5	1, 400, 000	95	[illegible]
Rye .... do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oats .... do....	15, [illegible]	33	472, 727	35	[illegible]
Barley .... do....	1, 125, 000	[illegible]	[illegible]	1 24	[illegible]
Buckwheat .... do....	257, 000	17. 2	[illegible]	1 05	[illegible]
Potatoes .... do....	3, [illegible]	[illegible]	[illegible]	63	2, [illegible]
Tobacco .... pounds..	374, 000	775	[illegible]	23	[illegible]
Hay .... tons..	1, 400, 000	1. 50	933, 333	[illegible]	[illegible]
Total	....	....	4, [illegible]	....	[illegible]
KANSAS.					
Indian corn .... bushels..	[illegible]	18	360, 388	$0 99	$[illegible], 422, 130
Wheat .... do....	1, 537, 000	15. 6	98, 525	1 35	2, [illegible]
Rye .... do...	[illegible]	20. 8	187	1 03	4, [illegible]
Oats .... do....	[illegible]	25	[illegible]	[illegible]	[illegible]
Barley .... do...	[illegible]	23	[illegible]	[illegible]	[illegible]
Buckwheat .... do....	[illegible]	17. 5	1, 314	1 27	[illegible]
Potatoes .... do....	850, 000	85	10, 000	[illegible]	[illegible]
Tobacco .... pounds..	130, 000	[illegible]	[illegible]	[illegible]	[illegible]
Hay .... tons..	[illegible]	1. 45	[illegible]	8 16	[illegible]
Total	....	....	[illegible]	....	[illegible], 467, 163
NEBRASKA.					
Indian corn .... bushels..	3, 185, 000	[illegible]	[illegible]	[illegible]	$[illegible]
Wheat .... do...	565, 000	15. 5	36, 451	96	[illegible]
Rye .... do...	1, 900	18. 3	[illegible]	1 00	[illegible]
Oats .... do....	544, 000	30. 4	17, 894	[illegible]	[illegible]
Barley .... do...	7, 000	25	[illegible]	1 41	[illegible]
Buckwheat .... do...	....	....	....	....	....
Potatoes .... do...	300, 000	66	4, 545	[illegible]	[illegible]
Tobacco .... pounds.	21, 000	525	40	[illegible]	[illegible]
Hay .... tons..	35, 700	1. 87	19, 090	[illegible]	[illegible]
Total	....	....	217, 485	....	3, [illegible]
CALIFORNIA.					
Indian corn .... bushels..	[illegible]	[illegible]	27, 111	$1 00	$[illegible]
Wheat .... do...	[illegible]	[illegible]	1, 050, 000	[illegible]	[illegible]
Rye .... do...	[illegible]	14	[illegible]	[illegible]	[illegible]
Oats .... do....	[illegible]	[illegible]	63, 333	70	[illegible]
Barley .... do...	[illegible]	[illegible]	375, 000	1 63	[illegible]
Buckwheat .... do....	[illegible]	[illegible]	777	1 00	14, [illegible]
Potatoes .... do...	2, 142, 000	[illegible]	[illegible]	56	1, [illegible]
Tobacco .... pounds..	....	....	....	....	....
Hay .... tons..	450, 000	[illegible]	328, 345	15 00	6, [illegible]
Total	....	....	[illegible]	....	42, 986, 520

Summary for each State, showing the amount, the number of acres, and the value of each crop for 1868.

States.	INDIAN CORN.			WHEAT.			RYE.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	1,590,000	53,355	$2,194,200	168,000	16,870	$403,200	145,000	9,666	$233,450
New Hampshire	1,511,000	43,171	2,160,730	257,000	21,965	621,940	136,000	10,625	214,880
Vermont	1,672,000	43,428	2,240,480	714,000	41,625	1,613,640	141,000	9,527	201,630
Massachusetts	2,292,000	61,975	3,025,440	166,000	10,709	398,400	445,000	27,639	738,700
Rhode Island	475,000	17,592	783,750	8,600	601	18,920	31,000	1,867	57,350
Connecticut	2,152,000	63,294	2,905,200	73,000	4,709	146,000	837,000	57,724	1,238,760
New York	20,910,000	653,457	23,419,200	8,497,000	581,986	17,673,760	4,845,000	320,860	6,637,650
New Jersey	10,216,000	272,426	10,113,840	1,432,000	103,021	3,021,520	1,358,000	100,592	2,037,600
Pennsylvania	31,979,000	913,685	31,979,000	15,300,000	1,195,312	30,294,000	6,558,000	496,818	8,656,560
Delaware	3,275,000	131,600	2,783,750	691,000	57,583	1,312,900	32,000	4,776	44,800
Maryland	12,349,000	445,812	10,743,630	5,706,000	559,411	11,925,510	503,000	41,570	679,050
Virginia	19,969,000	1,034,663	15,176,440	6,914,000	823,095	13,136,600	760,000	91,566	896,800
North Carolina	23,366,000	1,633,986	18,225,480	2,971,000	503,559	5,942,000	389,000	52,567	501,810
South Carolina	9,870,000	967,647	9,870,006	717,000	128,035	1,613,250	51,000	10,800	85,320
Georgia	27,294,000	2,149,133	24,837,540	1,832,000	327,142	4,030,400	70,000	10,144	119,000
Florida	2,950,000	280,952	4,159,500	1,000	111	2,750	9,000	900	15,750
Alabama	31,240,000	2,892,592	26,866,400	829,000	135,991	1,641,420	39,000	6,724	65,910
Mississippi	35,519,000	2,077,134	26,284,060	242,000	26,593	529,980	21,000	2,000	41,370
Louisiana	17,397,000	790,772	13,047,750	50,000	6,849	125,000	21,000	1,826	39,900
Texas	21,337,000	853,480	13,228,940	389,000	64,833	875,250	93,000	7,881	117,870
Arkansas	32,449,000	1,063,901	20,412,870	1,600,000	74,074	2,080,000	39,000	2,932	41,340
Tennessee	54,772,000	2,164,901	26,838,280	6,137,000	929,848	11,537,560	224,000	24,888	280,000
West Virginia	7,695,000	219,857	5,771,250	2,185,000	201,205	4,107,800	85,000	6,250	103,700
Kentucky	58,187,000	1,779,418	27,347,890	2,850,000	335,294	5,301,000	477,000	41,478	581,940
Missouri	60,967,000	2,012,112	34,751,190	5,357,000	382,642	7,981,930	269,000	14,540	258,240
Illinois	134,363,000	3,928,742	57,776,090	28,560,000	2,483,478	34,272,000	615,000	39,814	599,850
Indiana	90,832,000	2,671,529	47,232,640	17,366,000	1,550,535	26,049,000	423,000	28,389	448,380
Ohio	74,040,000	2,177,647	41,424,000	17,050,000	1,311,538	28,132,500	1,104,000	81,176	1,258,560
Michigan	18,815,000	574,151	14,299,400	16,012,000	1,280,960	26,259,680	606,000	33,480	660,540
Wisconsin	12,565,000	580,757	7,287,700	22,660,000	1,743,076	22,660,000	1,018,000	51,731	916,200
Minnesota	8,255,000	246,417	5,283,200	14,500,000	966,666	12,035,000	525,000	25,185	357,000
Iowa	65,332,000	1,765,729	21,172,840	20,300,000	1,400,000	19,285,000	577,000	30,568	490,450
Kansas	6,487,000	360,388	6,422,130	1,537,000	98,525	2,074,950	3,900	187	4,017
Nebraska	3,185,000	139,082	2,197,650	565,000	36,451	542,400	1,900	103	1,900
California	1,220,000	27,111	1,220,000	21,000,000	1,050,000	21,630,000	20,000	1,428	28,000
Total	906,527,000	34,887,246	569,512,460	224,036,600	18,460,132	319,195,290	22,504,800	1,651,321	28,683,677

Summary for each State, showing the amount, the number of acres, and the value of each crop for 1868.—Continued.

States.	OATS.			BARLEY.			BUCKWHEAT.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	1,862,000	84,636	$1,526,840	560,000	34,782	$705,670	348,000	15,130	$334,690
New Hampshire	1,232,000	46,490	936,320	80,000	3,703	117,600	78,000	3,940	72,540
Vermont	4,055,000	135,166	3,041,250	91,000	3,956	131,040	168,000	12,000	161,280
Massachusetts	1,261,000	52,323	1,134,900	138,000	6,865	215,220	73,000	5,530	78,840
Rhode Island	200,000	7,142	154,000	50,000	2,173	80,000	3,100	182	3,627
Connecticut	2,705,000	97,653	2,218,100	17,000	850	21,420	200,000	10,989	240,000
New York	25,000,000	961,538	18,500,000	3,840,000	179,439	6,835,200	5,886,000	298,781	5,944,860
New Jersey	5,368,000	239,642	3,703,920	26,000	1,135	40,300	852,000	51,017	1,090,560
Pennsylvania	55,168,000	1,982,362	55,269,120	590,000	27,570	967,600	8,224,000	498,421	8,964,160
Delaware	1,436,000	179,500	861,600	5,000	208	6,100	22,000	1,100	27,500
Maryland	6,096,000	338,666	3,901,440	23,000	973	28,060	188,000	10,653	225,600
Virginia	8,671,000	487,134	4,682,340	5,000	333	5,000	157,000	8,532	153,860
North Carolina	3,479,000	267,615	2,261,350	3,100	198	3,875	23,070	1,474	19,099
South Carolina	629,000	64,845	534,650	7,400	822	14,060	....	....	....
Georgia	1,132,000	90,560	894,284	11,800	761	25,370	....	....	....
Florida	13,800	1,260	13,800	3,000	[illegible]	6,000	....	....	....
Alabama	567,000	48,461	498,960	8,000	792	14,640	....	....	....
Mississippi	110,000	7,189	111,100	8,100	810	11,340	....	....	....
Louisiana	57,000	3,890	91,200	....	....	....	....	....	....
Texas	861,000	32,368	774,900	33,000	3,000	71,280	....	....	....
Arkansas	459,000	19,511	551,200	4,000	363	8,400	....	....	....
Tennessee	2,881,000	165,574	1,815,030	19,000	1,038	27,170	12,000	1,052	14,520
West Virginia	1,755,000	71,052	895,050	46,000	2,674	85,560	332,000	15,229	335,320
Kentucky	5,906,000	268,454	2,834,880	149,000	9,312	218,830	11,000	773	14,268
Missouri	4,529,000	137,659	1,947,470	166,000	6,859	288,840	64,000	3,699	65,920
Illinois	32,479,000	1,018,150	12,666,810	976,000	37,829	1,327,360	198,000	11,927	211,860
Indiana	11,285,000	425,849	5,191,100	335,000	16,311	525,950	370,000	19,170	351,500
Ohio	24,227,000	835,413	12,113,500	2,343,000	104,133	3,411,210	992,000	57,341	1,061,440
Michigan	7,552,000	251,229	3,781,000	430,000	18,451	670,800	1,267,000	65,309	1,038,940
Wisconsin	18,753,000	586,031	9,188,970	885,000	36,875	1,194,750	57,000	3,081	46,170
Minnesota	7,011,000	194,750	3,365,280	496,000	16,249	462,840	44,000	2,268	45,320
Iowa	15,600,000	472,727	5,461,000	1,125,000	43,269	1,395,000	257,000	14,941	269,850
Kansas	247,000	9,880	140,790	5,700	247	5,586	23,000	1,314	29,210
Nebraska	541,000	17,894	293,760	7,000	280	9,870	....	....	....
California	1,960,000	63,333	1,330,000	10,500,000	375,000	10,815,000	14,000	777	14,000
Total	254,960,800	9,665,736	142,484,910	22,896,100	937,498	29,809,931	19,863,700	1,113,993	20,814,315

Summary for each State, showing the amount, the number of acres, and the value of each crop for 1868—Continued.

States.	POTATOES.			TOBACCO.			HAY.		
	Bushels.	Acres.	Value of crop.	Pounds.	Acres.	Value of crop.	Tons.	Acres.	Value of crop.
Maine	5,500,000	42,307	$4,290,000	....	....	....	1,228,000	1,203,921	$14,736,000
New Hampshire	3,950,000	29,924	2,804,500	....	....	....	917,000	917,000	12,379,500
Vermont	4,800,000	35,555	2,889,000	....	....	....	1,010,000	990,196	14,645,000
Massachusetts	4,050,000	34,913	3,766,500	4,161,000	3,200	$957,030	1,207,000	881,621	22,172,590
Rhode Island	700,000	6,930	749,000	....	....	....	71,000	63,592	1,420,000
Connecticut	1,750,000	14,957	1,592,500	7,053,000	4,871	1,765,750	883,000	767,826	15,231,750
New York	25,340,000	269,574	19,258,400	12,000,000	15,000	1,500,000	4,500,000	4,500,000	67,500,000
New Jersey	3,670,000	37,835	3,559,900	150,000	214	15,750	486,000	347,112	9,234,000
Pennsylvania	11,852,000	134,681	11,022,360	4,617,000	5,596	369,360	2,443,000	1,813,333	34,168,000
Delaware	345,000	4,600	345,000	12,000	20	1,080	33,000	26,400	660,000
Maryland	1,205,000	12,819	1,120,650	16,404,000	29,292	1,771,632	219,000	171,093	3,672,630
Virginia	1,350,000	18,243	999,000	93,600,000	119,540	7,956,000	226,000	185,215	2,938,000
North Carolina	838,000	11,626	745,820	41,016,000	62,429	6,849,672	186,000	148,800	2,790,000
South Carolina	150,000	1,485	232,500	102,000	264	17,340	86,000	90,526	1,462,000
Georgia	318,000	3,117	470,640	1,212,000	2,071	363,600	61,000	61,009	1,335,900
Florida	18,000	163	30,600	480,000	905	134,400	8,530	8,500	172,500
Alabama	340,000	5,573	513,490	340,000	600	95,200	85,000	51,204	1,638,800
Mississippi	442,000	6,800	640,900	126,000	169	41,958	42,000	33,600	714,000
Louisiana	325,000	2,006	568,750	22,000	31	6,600	41,000	20,501	410,000
Texas	340,000	5,573	510,000	111,000	233	35,520	17,300	13,849	173,000
Arkansas	350,000	5,555	462,000	2,521,000	2,801	292,436	9,400	7,520	159,400
Tennessee	1,180,000	16,164	885,000	40,168,000	49,985	6,587,552	152,000	121,690	2,356,090
West Virginia	575,000	8,333	517,500	2,016,000	3,259	314,736	136,000	104,809	2,040,000
Kentucky	2,100,000	26,250	1,407,600	46,440,000	65,815	5,892,800	128,000	100,787	1,196,000
Missouri	1,040,000	11,555	936,000	10,957,000	13,765	1,238,141	652,000	425,714	7,172,000
Illinois	3,800,000	53,521	3,078,000	15,169,000	20,026	1,379,560	2,667,000	1,905,000	26,670,000
Indiana	3,190,000	35,227	2,395,000	7,237,000	10,265	759,885	1,280,000	918,148	11,195,200
Ohio	7,290,000	91,139	6,048,000	11,000,000	13,513	836,000	2,030,000	1,561,538	28,014,000
Michigan	5,650,000	60,106	3,164,000	3,430,000	3,118	720,300	1,473,000	1,178,400	22,095,000
Wisconsin	3,900,000	50,649	2,808,000	76,000	101	15,200	1,274,000	1,061,666	11,014,000
Minnesota	3,250,000	21,523	1,982,500	76,000	108	15,200	588,000	415,714	4,071,000
Iowa	3,370,000	35,104	2,123,100	374,000	482	86,020	1,400,000	933,333	9,100,000
Kansas	850,000	10,000	799,000	130,000	200	28,600	118,000	81,379	962,880
Nebraska	300,000	4,515	315,000	21,000	40	4,620	35,700	19,090	192,780
California	2,142,000	23,800	1,199,520	....	....	....	450,000	358,345	6,750,000
Total	106,090,000	1,131,552	84,150,010	320,982,000	427,189	40,081,942	26,111,900	21,511,573	351,941,930

3

A general summary, showing the estimated quantities, number of acres, and aggregate value of the principal crops of the farm in 1868.

Products.	No. of bushels.	No. of acres.	Value.
Indian corn	906, 527, 000	34, 887, 246	$569, 512, 460
Wheat	224, 036, 600	18, 460, 132	319, 195, 290
Rye	22, 504, 800	1, 651, 321	[illegible]
Oats	254, 960, 800	9, 665, 736	142, 484, 910
Barley	22, 896, 100	937, 498	[illegible]
Buckwheat	19, 863, 700	1, 113, 993	20, 814, 315
Potatoes	106, 090, 000	1, 131, 552	[illegible]
Total	1, 556, 879, 000	67, 846, 478	[illegible]
Tobacco ... pounds	320, 982, 000	427, 189	40, 081, 942
Hay ... tons	26, 141, 900	21, 541, 573	351, 941, 930
Cotton ... bales	2, 500, 000	7, 000, 000	225, 000, 000
Total	....	96, 816, 240	1, 811, 674, 495

Table showing the average yield and cash value of farm products per acre for the year 1868.

Articles.	Average yield.	Average value.	Articles.	Average yield.	Average value.
Indian corn ... bushels	25.9	[illegible]	Potatoes ... bushels	93.7	$74 36
Wheat ... do	12.1	17 29	Tobacco ... pounds	751	[illegible]
Rye ... do	13.6	17 37	Hay ... tons	1.21	16 33
Oats ... do	26.3	14 74	Cotton ... pounds	160.7	32 14
Barley ... do	24.4	31 79	Sugar ... do	1,504	
Buckwheat ... do	17.8	18 68			

Table showing the average yield of farm products per acre for the year 1868.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Potatoes.	Tobacco.	Hay.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Pounds.*	*Tons.*
Maine	29.8	10	15	22	16.1	23	130	....	1.02
New Hampshire	35	11.7	12.8	26.5	21.6	20	132	....	1
Vermont	38.5	16	14.8	30	23	14	135	....	1.02
Massachusetts	37	15.5	16.1	24.1	20.1	13.2	116	1,300	1.37
Rhode Island	27	14.3	16.6	28	23	17	101	....	1.12
Connecticut	34	15.5	14.5	27.7	29	18.2	117	1,450	1.15
New York	32	14.6	15.1	26	21.4	19.7	94	800	1
New Jersey	37.5	13.9	13.5	22.4	22.9	16.7	97	700	1.40
Pennsylvania	35	12.8	13.2	27.8	21.4	16.5	88	825	1.35
Delaware	25	12	6.7	8	24	20	75	600	1.25
Maryland	27.7	10.2	12.1	18	23.5	18.7	94	500	1.28
Virginia	19.3	8.4	8.3	17.8	15	18.4	74	783	1.22
North Carolina	14.3	5.9	7.4	13	15.6	15.6	76	657	1.25
South Carolina	10.2	5.6	5	9.7	9	....	101	500	0.95
Georgia	12.7	5.6	6.9	12.5	15.5	....	102	565	1
Florida	10.5	9	10	11.5	14.3	....	110	530	1
Alabama	[illegible]	6.1	5.8	11.7	10.1	....	61	566	1.66
Mississippi	17.1	9.1	10.5	15.3	10	....	65	783	1.25
Louisiana	22	7.3	11.5	15	....	....	162	700	2
Texas	25	6	11.8	26.6	11	....	61	466	1.25
Arkansas	30.5	13.5	13.3	22.5	11	....	63	900	1.25
Tennessee	25.3	6.6	9	17.4	18.3	11.4	73	815	1.25
West Virginia	35	10.7	13.6	24.7	17.2	21.8	69	641	1.25
Kentucky	32.7	8.5	11.5	22	16	15	89	705	1.27
Missouri	30.3	14	15.5	32.9	24.2	17.3	90	756	1.40
Illinois	34.2	11.5	16.2	31.9	25.8	16.6	71	757	1.40
Indiana	34	11.2	14.9	26.5	20.5	19.3	88	705	1.35
Ohio	34	13	13.6	29	22.5	17.3	79	814	1.30
Michigan	33	12.5	18.1	30.1	23.3	19.4	94	1,100	1.25
Wisconsin	33	13	15.6	32	24	18.5	77	750	1.20
Minnesota	33.5	15	20.6	36	25	19.4	151	700	1.40
Iowa	37	14.5	19	33	26	17.2	96	775	1.50
Kansas	18	15.6	20.8	25	23	17.5	85	650	1.45
Nebraska	22.9	15.5	18.3	30.4	25	....	66	525	1.87
California	45	20	14	30	28	18	90	....	1.33

Table showing the average cash value of farm products per acre for the year 1868.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Potatoes.	Tobacco.	Hay.
Maine	$41 12	$24 60	$24 15	$18 04	$29 28	$22 08	$101 40	....	$12 24
New Hampshire	50 05	28 31	20 22	20 14	31 75	18 60	93 72	....	13 50
Vermont	51 50	36 16	21 16	22 50	33 12	13 44	81 00	....	14 79
Massachusetts	48 84	37 20	26 72	21 69	31 35	14 25	107 83	$299 00	25 16
Rhode Island	41 55	31 46	30 71	21 56	36 80	19 89	108 07	....	22 40
Connecticut	45 90	31 00	21 46	22 71	25 20	21 84	106 47	362 50	19 83
New York	35 84	30 36	20 68	19 24	38 09	19 89	71 44	100 00	15 00
New Jersey	37 12	29 32	20 25	15 45	35 49	21 37	94 09	73 50	26 60
Pennsylvania	35 00	25 34	17 42	17 79	35 09	17 98	81 84	66 00	21 60
Delaware	21 25	22 80	9 38	4 80	29 26	25 00	75 00	54 00	25 00
Maryland	24 09	21 31	16 33	11 52	28 67	22 44	87 42	69 48	21 46
Virginia	14 66	15 96	9 79	9 61	15 00	18 03	54 76	66 55	15 86
North Carolina	11 15	11 80	9 54	8 45	19 50	12 94	67 64	109 71	18 75
South Carolina	10 20	12 60	7 90	8 24	17 10	....	156 55	85 00	16 15
Georgia	11 55	12 32	11 73	9 87	33 32	....	150 96	175 50	21 90
Florida	14 80	24 75	17 50	11 50	28 60	....	187 00	148 40	21 00
Alabama	9 28	12 07	9 80	10 29	18 48	....	92 11	158 48	32 00
Mississippi	12 65	19 92	20 68	15 45	14 00	....	94 25	260 73	21 25
Louisiana	16 50	18 25	21 85	24 00	....	....	283 50	210 00	20 00
Texas	15 50	13 50	18 75	23 94	23 76	....	91 50	149 12	12 50
Arkansas	19 21	27 00	14 09	18 00	23 10	....	83 16	104 40	20 00
Tennessee	12 39	12 40	11 25	10 96	26 16	13 79	54 75	133 66	19 37
West Virginia	26 25	20 11	16 59	12 59	31 99	22 01	62 10	104 48	18 75
Kentucky	15 36	15 81	14 03	10 56	26 72	18 45	53 60	89 53	16 82
Missouri	17 27	20 86	17 76	14 14	42 10	17 81	81 00	89 94	15 40
Illinois	14 70	13 80	15 06	12 44	35 08	17 76	57 51	68 88	14 00
Indiana	17 08	16 80	15 79	12 19	32 18	18 33	66 00	74 02	14 97
Ohio	20 40	21 45	15 50	14 50	33 07	18 51	66 36	61 86	17 94
Michigan	25 08	20 50	19 72	15 05	36 34	15 90	52 64	231 00	18 75
Wisconsin	19 14	13 00	16 74	15 68	32 40	14 98	55 44	150 00	13 20
Minnesota	21 44	12 45	14 00	17 28	28 50	19 98	92 11	140 00	9 80
Iowa	13 09	13 77	16 15	11 55	32 24	18 06	60 48	178 25	9 75
Kansas	17 82	21 06	21 42	14 25	22 54	22 22	79 90	143 00	11 83
Nebraska	15 80	14 88	18 30	16 41	35 25	14 12	69 30	115 50	10 09
California	45 00	20 60	19 60	21 00	28 84	18 00	50 40	....	19 95

Table showing the total average cash value of the above products per acre for the year 1868.

States.	Average value per acre.	States.	Average value per acre.
Maine	$16 72	Louisiana	$17 30
New Hampshire	18 03	Texas	16 11
Vermont	19 54	Arkansas	20 18
Massachusetts	29 96	Tennessee	14 48
Rhode Island	32 70	West Virginia	22 19
Connecticut	24 79	Kentucky	17 20
New York	21 49	Missouri	17 92
New Jersey	28 46	Illinois	14 52
Pennsylvania	23 58	Indiana	17 01
Delaware	14 91	Ohio	20 10
Maryland	21 16	Michigan	21 00
Virginia	16 59	Wisconsin	14 84
North Carolina	13 92	Minnesota	14 62
South Carolina	10 93	Iowa	13 28
Georgia	12 13	Kansas	18 62
Florida	15 50	Nebraska	16 35
Alabama	9 97	California	22 86
Mississippi	13 17		

CONDITION AND NUMBERS OF FARM STOCK.

The mildness of the present winter has been favorable to health and condition of all kinds of farm stock. In the more northern States there have been few sudden changes of temperature, few alternations from one extreme to another, and very little weather of much severity or discomfort to the denizens of the barn and stock-yard. The reported losses from

diseases of all kinds are less than for any year since this record has been systematically kept, showing conclusively that all cattle diseases are far less the result of climatic causes, or of feeding upon injurious plants and unwholesome fodder, than the effect of starvation, exposure, and neglect.

The condition of cattle, as compared with their status last year, is improved, except in Florida, Alabama, Mississippi, Kansas, and Nebraska. Cases of pleuro-pneumonia are reported in the vicinity of the cities of New York, Philadelphia, Baltimore, and Washington. The Spanish fever, communicated by southern cattle, caused a brief season of panic, and occasioned heavy local losses at points of reshipment in Kansas, Missouri, Iowa, Illinois, Indiana, and to a smaller extent eastward to the Atlantic coast. Abortion has been somewhat prevalent on dairy farms of the middle and eastern States. Black tongue, black leg, hollow horn, and a variety of "distempers," "murrains," and other undefined forms of disease are reported, but not to the usual extent. Less than one county in ten of the entire number reported the prevalence of disease, further than the slight ailments which rarely prove fatal. Not a county in Ohio or Michigan furnishes evidence of the existence of unusual disease among cattle.

Those States in which winter shelter is not provided are marked by a lower condition of farm stock, and a higher rate of mortality, than Maine or Minnesota. The southern States, the best portion of the country for stock-growing, have almost literally no provision either for feed or shelter in any portion of the year. As a business, stock production there is little more than an appropriation of spontaneous growth, costing neither money nor labor, except in the in-gathering or harvest.

The reports relative to sheep are not so favorable. The wool business has been comparatively unprofitable of late, and the inevitable result is neglect, short commons, a supply of moldy hay, and the roughest treatment, in too many instances resulting in leanness, weakness, and the insidious approaches of disease. Where they have been suitably cared for they are healthy, and as Merinoes are in present disfavor, disease is mainly among flocks of that breed. Were it not for the culling process, by which several millions of the poorest (sixty thousand in some cases in a single county) have been remorselessly slaughtered for their pelts and the small modicum of fat that could be drained by hydraulic pressure from their juiceless carcasses, the ravages of disease would have proved far greater. This weeding out of the victims of poverty will result beneficially in elevating the average of health and condition. Wool-growers whose fears have overcome their judgment and caused the depreciation of their flocks or the abandonment of their business, will ere long regret their hasty action. Already a reaction has commenced; prices of wool are stiffening, and the value of sheep is slightly advancing. If there is no legislative interference with the growth or manufacture of wool, a better day will soon dawn, and the time will prove auspicious for enlarging rather than abandoning the production of wool.

The States in which the comparison, in point of condition, is unfavorable with last spring, are Maine, New Hampshire, Vermont, Alabama, Mississippi, West Virginia, Missouri, Illinois, Indiana, Ohio, Michigan, Wisconsin, Iowa, and Kansas. The losses from disease, dogs, wolves, and freedmen and other plunderers in the South, together with the depreciation from slaughtering for pelts, present an unfavorable comparison with the previous year in almost every State in the Union, and represent a total reduction in numbers of not less than 4,000,000. Yet all these losses exclusive of the voluntary destruction of sheep for their wool, skins,

and fat, make an aggregate of loss no greater than that of the previous year.

Horses, being valuable, are generally well fed and stabled, and appear to have been remarkably exempt from disease the past year. Glanders, which became so prevalent in the territory swept by the ravages of war, is a disease yet dreaded, though far less common than in 1866 and 1867. Blind staggers is yet common, especially in miasmatic localities; charbon is fatal in Arkansas and elsewhere in the southwest; lung fever and other diseases are occasionally reported.

The following notes, furnishing briefs of the most noticeable data received, will give an idea of the extent and character of the diseases of farm animals during the past year, though the returns are necessarily deficient in veterinary accuracy:

DISEASES OF CATTLE.

For several years past there has been some loss of cattle in mountain pastures of New Hampshire, from some unknown form of disease. The cattle are generally found dead before any appearance of sickness has been observed. A few cattle in Massachusetts have died from eating "smut corn." Pleuro-pneumonia has been very fatal for the past twelve or fifteen years in King's County, New York. Since vaccination has been practiced, the loss has been diminished greatly.

A new disease prevails among milch cows in Erie County, New York. Symptoms: watery eyes, yellow matter running from nostrils, breathing heavy, blood passing from the intestines, cramps, resulting in death in eight to twelve hours. A few cases have been saved by giving calomel in doses of twenty to thirty grains, in cold water, once in three or four hours.

It is remarked in Pennsylvania that disease among horned cattle, so destructive during the last few years, has almost entirely disappeared. The principal remedy applied appears to have been simply a complete renovation of barns and stalls, ventilation and free use of lime, and a regular, healthy diet.

Pleuro-pneumonia has prevailed considerably in Delaware County, Pennsylvania, proving fatal to animals first attacked, but becoming milder, so as to admit of treatment in subsequent cases.

Our correspondent in Baltimore County, Maryland, says:

> We have had the pleuro-pneumonia in our county among cattle during the past three years. The malady has been very destructive, some individuals losing almost their entire herds. The disease is of a highly contagious character, and the most skillful cattle surgeons are unable to control it. The losses have been much lighter during the past year. Sixteen valuable Ayrshire cows perished in one stable; a few other losses, varying from five to fifteen, occurred. In most of the stables where the disease prevailed with great virulence the previous year it has subsided, owing to a strict quarantine. The careful isolation of the infected herds had the desired effect in reducing the malady to a much smaller scale.

Pleuro-pneumonia attacked one herd in Prince George County, Maryland, and four or five died. *The remainder were sent to Washington for beef*, and the disease did not spread.

In Lawrence County, Indiana, there has been considerable mortality among calves weaned in the fall, dying during the winter with bloody diarrhœa. After death there was found underneath the skin a quantity of yellow serum; and even before death this yellow serum would collect in dependent portions of the body, where there was loose skin, as under the jaw. About half of the calves that were attacked died.

The inhumanity disclosed in reports of losses from "want of shelter," from "starvation," and from "small quantity of food," is sickening

and disgusting to any one possessed of a single kindly impulse. There is no portion of the country where shelter and feeding are not requisite at times. In Texas, where cattle grow and thrive by millions, are places where, during the present season at least, "fully twenty per cent. die in the latter part of the winter and early spring from poverty." It is gratifying to remark, amid the general neglect of this latitude, that in one county in Georgia "those that have been housed look well," and that in another "they are better than usual from being cared for."

THE SPANISH FEVER.

The ravages of the Spanish or splenic fever were greater last season than ever before. The mode of transportation, by steam eastward from the frontier railway stations, and up the Mississippi river in steamboats, brought the contagion into the heart of the country and disseminated it from the Mississippi to the Atlantic. Formerly it was confined to the frontiers, the length of time elapsing in travel on foot sufficing to eliminate the virus of the disease from the systems of the emigrating cattle before their arrival on the banks of the Mississippi.

A few cases are reported in the eastern States—in New York, New Jersey, and in Lancaster County, Pennsylvania.

In Ohio, slight losses were suffered in Hamilton County; six head, among two car loads, in Wyandot; a few cases in Greene, Mercer, and Hancock.

In Indiana, from four to six hundred cases in Benton County; two droves were destroyed in Jasper County; one hundred deaths are reported in Marion, and losses are given in White, Newton, and Hendricks.

In Illinois, among other reports, are losses in Ford County of five hundred head; one hundred in Grundy; large numbers in Champaign, (valued at $150,000 at least;) forty in Douglas; nineteen in Clinton; and small losses in Massac, Pulaski, Effingham, Cook, Iroquois, Macon, Pope, Morgan, Alexander, St. Clair, and Du Page.

In Missouri heavy losses occurred; in St. Louis there were one thousand four hundred cases of cows and three hundred of heifers; in Newton the loss numbered three hundred. In many other sections of the State the disease was more or less prevalent, as in McDonald, Butler, Clark, Polk, Bates, Cass, Henry, Montgomery, Benton, Mississippi, Cedar, Dade, and Hickory; but the details of these returns, together with those of other States, are reserved for a more complete history of the outbreak.

Five western cattle died of Spanish fever at Millerton, Dutchess County, New York, where they were quarantined. The infection did not spread.

A large number of Texas and Indiana cattle were brought into the cattle yards and abattoirs in Hudson County, New Jersey, last August, sick with Spanish fever. The State Agricultural Society forbade any more being brought into the State. Those sick were quarantined, and after a thorough examination were put into rendering vats and the yards and pens disinfected with carbolic acid. No disease afterward appeared. Three inspectors were appointed by the State society, who quarantined all the suspected cattle on arrival; and when it proved sickness from any infectious disease they were killed and put in the rendering vats.

A lot of western cattle were driven through Westmoreland County, Pennsylvania, last summer, stopping over night on a farm three miles

south of Greensburg. Eight or ten head took sick during the night, and were left with the farmer to be killed. The symptoms were said to be those of Spanish fever.

Reports of the existence of this disease have come from Georgia, but the symptoms are not sufficiently defined for its absolute identification.

Our Lamar County (Texas) correspondent states, as the result of his observations in Texas and other States, including Illinois at the time of the greatest virulence of the disease there, that there is no such disease in Texas, or south of the latitude of middle Tennessee or Arkansas. He mentions the fact that hundreds were herded for months on Grand Prairie, Arkansas, at the season of the highest excitement in Illinois, without disease among either Texas or Arkansas stock. The following points are indicated as the result of his observations:

1. That it did not show itself until the very hot weather that visited that section, although Texas cattle had come in nearly two months before.

2. That Texas cattle were free from any signs of disease, and improved rapidly on arrival.

3. That, although healthy, they left disease behind them; and all home cattle feeding upon the same pastures or drinking at the same fountains were in danger of the contagion.

4. That removal to new pastures and clean water would stay the progress of the disease among those not yet affected by it.

5. That native cattle would not take the disease from running on new pasture with other native cattle, although the latter might be suffering and dying with the disease.

6. That the disease, its mode of action and of communication, and the remedies, were mysterious.

It is reported from Fayette County, Texas, that Spanish fever only prevails among unacclimated animals. A teaspoonful each, of spirits of turpentine, copperas, and sulphur, is claimed there to be a certain cure if given in time.

The following extracts, from detailed reports published in the Monthly, give an indication of its prevalence in the central portions of the west:

MISSOURI.

Newton County.—Prevailed during the summer and fall. Loss not over three hundred head.

McDonald County.—Five per cent. of all native cattle have been lost. Texas cattle do not suffer unless there is an admixture of more than one-half native blood. Remedies prove unavailing.

Clark County.—Has visited some portions of the county.

Butler County.—Three cases reported. Remedy used: a drench made by mixing half a pound of Epsom salts with a strong decoction of peach-tree leaves—one quart of the latter.

Polk County.—In the eastern part of the county, in August, from the passage of Texas cattle through that section.

St. Louis County.—Fourteen hundred milch cows and two hundred and fifty to three hundred heifers and steers lost by this disease.

Bates County.—To some extent, but less than in years past.

Cass County.—Few losses this year, as diligent watch has been kept against droves.

Henry County.—Loss two hundred to three hundred head.

Montgomery County.—Forty-five head lost last autumn. Only three of those attacked recovered.

Benton County.—A few isolated cases.

Mississippi County.—Slightly; brought in from Cairo, Illinois, by Texas cattle. Loss forty head.

Cedar County.—A few cases imported with southern cattle.

Dade County.—During the summer and fall, along the highways where Texas cattle stopped to graze; the loss was twenty-five per cent.

Hickory County.—To some extent, but no new facts noted.

ILLINOIS.

Champaign County.—Our correspondent says: "Spanish fever has prevailed in this county, commencing on the 27th day of July, 1868, and cattle have continued to die of the same disease up to January 1, 1869. In this township the loss is ninety per cent.; entire county, seventy-five per cent. It is a blood disease; the blood under a powerful glass proves this. It has been argued, and tried to be proven, that it is a disease not easily taken. I now have in my possession a large amount of evidence from good men, showing it to be a disease very easily given. A number of cases can be given where the only exposure was by driving a short distance over the road where the Texas cattle had passed from train pasture to barn lots, the natives being kept up all the time only when in transit from lots to pasture. Blood examined in the earliest stages of the disease shows a diseased condition of the same. As the disease progresses from day to day the blood, examined by a good glass, shows the gradual destruction of vitality, and at dissolution is a mass of putridity."

Clinton County.—Spanish fever among the cattle; loss nineteen head.

Douglas County.—Forty head lost from Spanish fever in one neighborhood through which Texas cattle passed.

Iroquois County.—Spanish fever has prevailed.

Mason County.—No cases except those that came in contact with one lot of Texas cattle.

Monroe County.—A few cases, supposed to be Spanish fever.

Pope County.—Spanish fever in one locality for a short time.

Morgan County.—A few drove cattle died, but more from ill usage than Spanish fever.

Alexander County.—Spanish fever prevailed in Cairo, but did not get into the country.

Cook County.—Some Spanish fever in the south part of the county, from contact with cattle shipped to Chicago.

Effingham County.—Spanish fever killed a few cattle in one neighborhood, where some Texas cattle were herded for a short time. Loss small.

Ford County.—Loss about five hundred head; a majority of them cows.

Grundy County.—Spanish fever in one town; loss about one hundred head.

Pulaski County.—A few deaths from the passing of Texas cattle.

St. Clair County.—A few head have died from supposed Spanish fever.

Du Page County.—One man lost eighteen head by Spanish fever.

INDIANA.

Marion County.—About one hundred head died of Spanish fever.

White County.—Some loss from Spanish fever.

Benton County.—From four hundred to six hundred head of native cattle have died from Spanish fever. In a neighboring county a herd of diseased cattle were driven about eight miles along a road, and, the wind being from the south, cattle along on the north side of the road took the disease, without either being driven along the road traveled by the Texas cattle or drinking water that had been exposed in any manner. These facts induce the belief that the disease was communicated by the wind. The Texas cattle were taken right off the cars and driven along the road.

Hendricks County.—Spanish fever in a few places. Comparatively little loss.

Newton County.—Eight to ten head died of Spanish fever, taken from a drove of Texas cattle driven along the road.

Lawrence County.—Considerable loss from Spanish fever along a road traveled by a drove of Texas cattle.

OHIO.

Hamilton County.—Very slight, and only among the cattle that have come in contact with foreign stock.

Wyandot County.—Lost six head, in two car-loads brought from Chicago.

Greene County.—Ten to twelve native cattle died. Disease taken from Texas cattle.

KANSAS.

Dickinson County.—Spanish fever has prevailed to a great extent. Loss over six thousand dollars.

Franklin County.—Ten head of oxen died of Spanish fever last fall, after feeding on the track of Texas herds. A few cases recovered.

Butler County.—Cases last summer and fall. Many of the Texas cattle have died here during the winter.

Wyandott County.—Six fatal cases in the fall; contact with Texas cattle.

DISEASES OF HORSES.

Horses have been comparatively free from disease during the year. Glanders, so prevalent after the close of the war, is now scarcely to be found. Pneumonia has caused some loss in New York, Pennsylvania, Illinois, and Missouri. Blind staggers has been somewhat fatal in the south and west. Less fatality is reported in the southwest from "charbon" than for several previous years. In Clinton County, Illinois, forty or fifty abortions occurred among mares. Other diseases are mentioned in various localities, as diphtheria, putrid sore-throat, inflammation of the liver, the "loin disease," and other diseases known only by reported symptoms.

DISEASES OF SWINE.

The losses from "hog cholera," though less than last year, are very heavy in the south and west. In New England and New York it only appears among western droves. Pennsylvania has been nearly exempt. In Virginia it has prevailed in a few counties, and in the Carolinas pretty extensively, in some counties the loss reaching thirty per cent. Similar reports come from portions of all the Gulf States. In Kentucky and Tennessee, where corn, hogs, and distilleries abound, it is still worse. The details have been annually presented *ad nauseam*, and we propose to omit those of the present year, giving only an idea of the extent of the loss in the districts most infected.

In nineteen counties in Tennessee, in which were 641,080 hogs in 1860, the loss in 1868 was about 140,000, according to the percentages of loss returned from the several counties; in twelve counties in Kentucky a loss of thirteen per cent., or 44,000; in nine counties of Indiana a loss of fifteen per cent., or 47,000—an aggregate loss of 231,000 swine in forty counties, averaging to each county 5,775.

DISEASES OF SHEEP.

Foot-rot, scab, and rot are reported in all sections of the country to a greater or less extent, causing a small percentage of mortality, varying in proportion to the degree of neglect suffered.

The reduction of numbers during the winter, in the general slaughter of culls for pelts and tallow, relieved the flocks of the country of the old, weak, and diseased sheep, and left those remaining in better condition, and with a better prospect of health and needful attention.

In Kennebec County, Maine, a fatal disease of the head and throat appeared. It was attended with loss of appetite, the flesh and skin became a dull green, and death ensued in a few days; decomposition was rapid, and the odor "fearfully fetid." Scanty pasture in the fall, and poor condition, were assumed to be predisposing causes. Merinoes were principally affected.

In parts of New Hampshire great fatality among sheep has been reported. A disease called "water garget" has been slightly prevalent in Merrimack County.

It is stated that in Hampden County, Massachusetts, three-tenths of the lambs have died from want of natural food, many of the mothers having little milk.

A flock of one hundred and fifty lambs in Winnebago County, Illinois, dropped in May, did well until a few days after the hot term in July, when many of them were taken with severe purging, as in cholera; a few, without purging, wandered around in a small circle, nibbling grass and dirt. All of the latter and most of the first cases died in a few

hours after being attacked. They commenced dying at the rate of two or three a day the first week, increasing to four or five a day in the third week, when they were taken from the ewes. Eighty were driven to another pasture; the remaining twenty-four, affected with the appearance of dysentery, were put in the sheep-barn and treated for that disorder. Of the latter nine died; of the former, but one. None of the sheep were affected.

A great many lambs died in Monroe County, Ohio, many of them apparently in good order. The mortality was greatest when the drought was most severe last summer, and the grasshoppers most abundant, and many think the excrements from the latter on the grass were poisonous.

In a flock in Houston County, Minnesota, occurred several cases of sores under the shoulder, in one or two instances involving face and legs, emitting watery matter and a noisome odor. One died after suffering two years. Sulphur proved to be a partial remedy.

LOSSES AND DEPREDATIONS BY DOGS.

Letters from correspondents in every section of the country lament the ravages of dogs, the many losses incurred by the killing and maiming of sheep, and especially the far greater loss in the repression of wool-growing and the prevention of efforts for its extension into regions peculiarly adapted to the business. Millions of acres of herbage, suited to the wants of fine-wool sheep in all portions of the United States, are annually depastured partially, or not at all, and left to decay and waste, for want of animals to consume the abundant spontaneous growth. Millions of dollars are thus annually lost to the production of the country. The following quotations are merely samples of statements from every quarter:

Hartford County, Conn.—"Formerly every farm kept from twenty to three hundred sheep; now there are very few, the dogs having driven them all out."

Baltimore County, Md.—"Many sheep are annually lost by the ravages of dogs."

Monroe County, West Va.—"Loss by wolves and dogs ten per cent. annually."

Burke County, N. C.—"Were it not for the dogs, sheep-raising could be carried on with very little cost and trouble in this section of our State." *Orange County.*—"A great many sheep killed by dogs. We wish Congress would impose a tax on all dogs." *Stanly County.*—"Sheep-raising would be profitable but for the depredations of dogs."

Stewart County, Ga.—"Not raised on account of dogs; twenty dogs to one sheep here."

Putnam County, Fla.—"The raising of sheep here is impracticable from the fact that nearly every negro and many whites keep a lot of half-starved curs, which they call "hunting dogs," but all the evidence of their hunting qualities that I have yet seen is that they will destroy a flock of sheep in about twenty minutes."

Giles County, Tenn.—"The dogs, 'curs of low degree,' have played havoc with the sheep. O for a dog law! A neighbor of mine lost thirty-five fine Southdowns in one night, among them two bucks worth one hundred dollars each, either one worth more than all the dogs in the county." *Perry County.*—"Dogs kept in a starving condition prevent success with sheep. Otherwise wool-growing might be profitable."

Livingston County, Ky.—"Wool-growing would be profitable if it were not for ravenous dogs."

Monroe County, Ohio.—"Dogs have been very bad on sheep. One farmer lost sixty in one night."

Harrison County, Ind.—"The township trustee of Corydon has paid out to farmers, for loss of sheep by dogs for the year ending March 1, three hundred and ninety-eight dollars, at the rate of two dollars per head. The amounts paid out by the other townships would probably make a total of one thousand dollars for the county." *Spencer County.*—"Lost one thousand sheep by dogs—more than ever before."

Douglas County, Ill.—"Lost two hundred sheep by dogs."

Stearns County, Minn.—"The most serious obstacle to successful sheep-raising is the multitude of worthless dogs, which threaten to exterminate the sheep."

Lee County, Iowa.—"Without legislative protection from dogs, wool in our State cannot be made profitable at present prices."

Atchison County, Kansas.—"Some of our farmers have disposed of their flocks mainly in consequence of the destruction by dogs and prairie wolves. Dogs are quite numerous and the greatest nuisance, and I think our legislature should tax them heavily."

The following statement represents the losses from dogs in Ohio during ten years, so far as they were returned by assessors:

Sheep killed or injured.

Years.	Number killed.	Value.	Number injured.	Value.
1858	60, 536	$109, 061	36, 441	$37, 097
1859	40, 786	74, 753	23, 409	24, 842
1860	41, 979	77, 170	22, 750	25, 288
1861	31, 750	75, 000*	24, 254	30, 000*
1862	36, 778	101, 561	24, 972	34, 786
1863	32, 175	166, 607	22, 657	39, 419
1864	30, 716	130, 069	21, 037	44, 026
1865	31, 118	112, 367	21, 681	41, 729
1866	27, 175	89, 797	17, 128	32, 208
1867	34, 141	92, 713	19, 416	31, 114
Total	357, 154	1, 029, 698	233, 745	340, 509

* Estimated.

Thus the average for this period is 35,715 killed per annum, and 23,374 injured; the annual average losses, respectively $102,969 and $34,050—total, $137,019. In Iowa, in 1866 the loss sustained, so far as reported by assessors, was $82,616 from sheep killed, the total stock of the State being 1,598,226. The same ratio would make the loss in the United States $2,080,000, without counting the damage from maiming.

The loss of New York, in 1862, as estimated by Secretary Johnson of the State Agricultural Society, was 50,000 sheep, worth $175,000. On this basis the loss in the United States would amount to $2,000,000.

Returns made by correspondents of this department in 1866 from five hundred and thirty-nine counties give an aggregate of 130,427 sheep killed, or an average of 242 in each county. On this basis the number killed in all the States would be about half a million.

Similar returns, in 1867, from three hundred and eighty-nine counties, report a total of 78,375 sheep killed, an average per county of 201. The proportion of loss is greatest in the southern States, where the business of wool-growing needs most encouragement and promises the most successful results. The average numbers killed per county in the counties reported are greatest in the following States: In Mississippi, 569 per county; Texas, 372 per county; Tennessee, 331 per county; New Jersey, 287 per county; Ohio, 263 per county; Iowa, 261 per county; Missouri, 253 per county; Indiana, 252 per county.

The Ohio average is for twenty-two counties, and is less than the average for the entire State, which was 383 per county by the assessors' returns for 1867.

A careful analysis of these facts, and of other data of similar purport, justifies the estimates previously made in these reports of an annual loss of two millions of dollars in sheep killed, and nearly a million in injuries. The loss is equivalent to the value of six millions of pounds of wool. It is a tax of two per cent. upon the total sum invested in sheep—a tax greater than the average levied upon farmers by the assessors for county, State, and national purposes combined. Such a burden is intolerable—a drain upon the profits of industry that should speedily be checked.

There are not less than six millions of dogs in the country, of which five are utterly worthless, destroying food worth many millions of dollars, committing serious depredations upon farm property, and repressing and depressing wool industry to the injury of business and the loss of national wealth.

Will not our national legislators heed the call from every State in the Union for the levy of a national tax upon dogs? Great Britain has for a long period levied and collected such a tax; other countries include it in their tax lists. There is no nation in which a greater necessity exists for such taxation. A uniform tax of not less than two dollars per head should be required. Its influence would be in every way salutary. Losses of wool-growers would decrease, and the business be extended into localities where it is now unprofitable. Mongrel curs too worthless to be claimed by owners would be sacrificed, useful dogs would be protected, and canine tribes would experience an improvement gratifying to all who appreciate the desirable qualities of the race, and a nuisance would be abated to the benefit of all and the injury of none.

Table showing the total value of live stock in the following States in 1860, *February* 1, 1868 *and February* 1, 1869.

States.	1860.	February 1, 1868.	February 1, 1869.
Maine	$15, 437, 533	$19, 974, 800	$23, 801, 314
New Hampshire	10, 924, 627	12, 474, 029	15, 113, 113
Vermont	16, 241, 989	20, 418, 952	22, 782, 711
Massachusetts	12, 737, 744	19, 214, 502	22, 807, 568
Rhode Island	2, 042, 044	2, 869, 744	3, 786, 043
Connecticut	11, 311, 079	18, 699, 012	24, 687, 141
New York	103, 856, 296	166, 557, 969	182, 766, 369
New Jersey	16, 134, 693	25, 502, 769	32, 595, 638
Pennsylvania	69, 672, 726	112, 118, 603	121, 138, 589
Delaware	3, 144, 706	4, 263, 973	4, 445, 632
Maryland	14, 667, 853	18, 992, 336	22, 178, 887
Virginia	35, 420, 369	35, 148, 572	37, 705, 568
North Carolina	31, 130, 805	20, 052, 456	24, 434, 747
South Carolina	23, 934, 465	10, 693, 117	15, 361, 888
Georgia	38, 372, 734	26, 463, 675	34, 692, 001
Florida	5, 553, 356	4, 190, 484	5, 007, 939
Alabama	43, 411, 711	21, 126, 832	27, 255, 962
Mississippi	41, 891, 692	16, 815, 802	28, 545, 453
Louisiana	24, 546, 940	8, 492, 468	15, 162, 289
Texas	42, 825, 447	33, 606, 563	32, 651, 895
Arkansas	22, 096, 977	15, 309, 989	20, 366, 380
Tennessee	60, 211, 425	38, 708, 702	53, 136, 552
West Virginia	12, 382, 680	15, 679, 734	17, 088, 568
Kentucky	61, 868, 237	40, 491, 619	49, 189, 403
Missouri	53, 693, 673	50, 728, 286	64, 490, 717
Illinois	72, 501, 225	109, 798, 764	120, 589, 917
Indiana	41, 855, 539	72, 796, 080	79, 728, 236
Ohio	80, 384, 819	123, 834, 351	140, 991, 600
Michigan	23, 714, 771	50, 084, 011	54, 426, 109
Wisconsin	17, 807, 375	54, 851, 907	55, 507, 096
Minnesota	3, 642, 841	16, 301, 354	18, 612, 171
Iowa	22, 476, 293	75, 718, 514	95, 109, 517
Kansas	3, 332, 450	9, 962, 311	12, 902, 830
Nebraska	1, 128, 771	5, 169, 536	7, 186, 454
California	35, 585, 017	....	41, 457, 732
Total	1, 075, 940, 902	1, 277, 111, 816	1, 527, 704, 029

Table showing the estimated total number and total value of each kind of live stock, and the average price in February, 1869.

States.	Horses.			Mules.			Oxen and other cattle.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	53, 252	$120 15	$6, 398, 227	....	....	....	165, 013	$50 70	$8, 366, 159
New Hampshire	36, 154	89 94	3, 251, 690	....	....	....	121, 712	47 76	5, 812, 965
Vermont	49, 714	91 78	4, 562, 750	....	....	....	147, 690	42 47	6, 272, 394
Massachusetts	50, 463	130 24	6, 572, 391	....	....	....	107, 036	54 41	5, 823, 828
Rhode Island	6, 828	102 38	699, 050	....	....	....	20, 398	72 93	1, 487, 626
Connecticut	36, 868	122 00	4, 497, 896	....	....	....	149, 749	62 31	9, 330, 860
New York	459, 502	104 78	48, 146, 619	2, 181	$132 98	$290, 029	748, 349	46 67	34, 925, 417
New Jersey	83, 623	143 03	11, 960, 597	8, 192	167 88	1, 375, 272	94, 268	53 59	5, 051, 822
Pennsylvania	408, 660	106 86	43, 662, 996	15, 349	136 08	2, 088, 691	721, 362	36 59	26, 394, 635
Delaware	17, 587	99 16	1, 743, 926	2, 561	141 65	362, 765	39, 728	30 44	1, 209, 320
Maryland	85, 951	104 93	9, 018, 838	11, 057	143 12	1, 582, 477	113, 310	31 44	3, 562, 466
Virginia	188, 386	80 69	15, 183, 911	28, 422	110 72	3, 146, 883	287, 846	20 39	5, 869, 179
North Carolina	98, 441	91 90	9, 046, 727	33, 542	112 77	3, 782, 531	281, 320	11 11	3, 125, 465
South Carolina	39, 821	112 97	4, 498, 578	32, 559	130 12	4, 236, 577	157, 723	14 41	2, 272, 788
Georgia	74, 095	115 12	8, 529, 816	69, 502	145 11	10, 085, 435	338, 343	13 83	4, 679, 283
Florida	7, 149	108 99	779, 169	6, 638	162 32	1, 077, 480	170, 677	9 34	1, 594, 123
Alabama	86, 720	89 32	7, 745, 830	85, 645	111 25	9, 528, 006	235, 297	12 73	2, 995, 330
Mississippi	68, 619	112 96	7, 751, 202	74, 710	139 38	10, 413, 079	227, 957	14 26	3, 250, 666
Louisiana	34, 216	119 28	4, 081, 284	57, 346	138 50	7, 942, 421	127, 529	10 70	1, 364, 560
Texas	274, 857	31 11	8, 550, 801	66, 155	48 91	3, 235, 641	2, 095, 745	5 78	12, 113, 406
Arkansas	109, 952	71 64	7, 876, 961	52, 309	88 56	4, 632, 485	151, 801	11 24	1, 706, 243
Tennessee	293, 649	93 86	27, 561, 895	70, 183	110 39	7, 747, 501	219, 269	17 14	3, 757, 242
West Virginia	74, 260	77 72	5, 766, 824	1, 236	92 03	113, 749	204, 000	29 49	6, 015, 969
Kentucky	221, 268	73 85	16, 340, 641	63, 366	89 90	5, 696, 603	331, 441	31 03	10, 281, 707
Missouri	372, 729	63 97	23, 843, 474	75, 746	83 75	6, 343, 727	590, 051	21 76	12, 839, 509
Illinois	677, 312	73 23	49, 599, 557	61, 742	93 60	5, 779, 051	867, 962	27 35	23, 738, 760
Indiana	424, 275	73 12	31, 022, 988	26, 054	77 69	2, 024, 135	465, 466	26 66	12, 409, 323
Ohio	710, 000	80 85	57, 403, 500	25, 500	89 74	2, 288, 370	749, 500	34 04	25, 512, 980
Michigan	218, 435	88 36	19, 300, 916	1, 006	98 64	99, 231	359, 326	34 78	12, 497, 358
Wisconsin	251, 446	91 09	22, 904, 216	2, 716	115 75	314, 377	422, 725	27 93	11, 806, 709
Minnesota	67, 338	91 18	6, 139, 878	1, 052	115 71	121, 726	198, 562	25 68	5, 099, 072
Iowa	454, 780	90 47	41, 143, 946	18, 675	100 80	1, 882, 440	686, 054	27 14	18, 619, 505
Kansas	50, 573	72 72	3, 677, 668	2, 597	80 81	209, 863	165, 430	26 87	4, 445, 104
Nebraska	19, 356	93 73	1, 814, 237	1, 372	140 91	193, 328	99, 691	29 84	2, 974, 779
California	226, 634	52 71	11, 945, 878	21, 249	73 92	1, 792, 486	323, 112	27 86	9, 001, 900
Total	6, 332, 793	....	533, 024, 787	921, 662	....	98, 386 359	12, 185, 385	....	306, 211, 473
Grand average of prices	....	84. 16	....	....	106. 74	....	....	25. 12	....

Table showing the number, price, and value of the live stock, &c.—Continued.

States	MILCH COWS.			SHEEP.			HOGS.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	131,189	$51 38	$6,740,490	602,033	$3 07	$1,848,911	32,037	$13 99	$448,197
New Hampshire	81,130	55 00	4,462,150	439,787	2 45	1,077,478	27,445	18 54	508,830
Vermont	186,067	50 07	9,316,374	833,651	2 67	2,225,848	28,326	14 31	405,315
Massachusetts	137,483	67 50	9,280,102	169,898	3 37	518,932	38,016	15 32	582,405
Rhode Island	21,815	60 00	1,308,900	36,598	3 93	143,790	9,951	14 74	146,677
Connecticut	139,011	66 66	9,266,473	168,015	4 72	793,172	47,686	16 75	798,740
New York	1,459,866	54 14	79,037,145	4,247,359	3 05	12,954,414	616,696	12 02	7,412,685
New Jersey	148,966	70 50	10,502,103	188,133	4 61	867,293	190,124	14 93	2,838,551
Pennsylvania	663,935	47 11	31,277,977	3,045,581	2 62	7,979,422	919,951	10 59	9,734,868
Delaware	18,158	40 00	726,320	15,364	3 50	53,774	42,367	8 25	349,527
Maryland	90,785	45 44	4,125,270	261,764	4 16	1,088,938	331,860	8 44	2,800,898
Virginia	279,258	28 76	8,031,460	592,761	2 40	1,422,626	922,895	4 39	4,051,509
North Carolina	205,590	20 71	4,257,768	296,372	1 71	506,796	858,074	4 33	3,715,460
South Carolina	136,395	23 85	3,253,020	161,877	1 77	286,5[illegible]	200,592	4 06	814,403
Georgia	259,954	22 36	5,812,571	292,833	1 62	474,389	1,362,802	3 75	5,110,507
Florida	81,121	15 00	1,216,815	4,754	2 80	13,311	103,494	3 16	327,041
Alabama	182,950	21 33	3,902,323	252,007	1 37	345,249	707,810	3 87	2,739,224
Mississippi	166,810	22 91	3,821,617	173,664	1 90	329,961	603,099	4 94	2,978,998
Louisiana	52,451	20 28	1,063,706	57,720	1 54	88,888	170,255	3 65	621,430
Texas	601,593	9 12	5,486,528	786,002	1 38	1,084,682	1,014,343	2 15	2,180,837
Arkansas	120,003	21 75	2,610,065	114,851	2 71	311,246	768,900	4 20	3,229,380
Tennessee	209,963	28 04	5,887,362	271,962	2 04	554,802	1,475,387	5 17	7,627,750
West Virginia	74,900	34 23	2,563,827	862,400	1 67	1,440,208	270,000	4 40	1,188,000
Kentucky	147,859	36 46	5,390,939	868,989	2 56	2,224,611	1,560,186	5 93	9,251,903
Missouri	349,440	31 21	10,906,022	1,584,179	1 79	2,835,680	2,042,938	3 78	7,722,305
Illinois	528,572	38 11	20,143,878	2,380,694	1 86	4,428,090	2,007,195	8 42	16,900,581
Indiana	427,111	36 48	15,581,009	2,622,780	1 63	4,275,131	2,194,163	6 57	11,115,6[illegible]0
Ohio	747,250	43 00	32,131,750	6,300,000	1 70	10,710,000	1,500,000	8 63	12,945,000
Michigan	292,435	44 62	13,048,449	3,553,371	1 87	6,644,803	401,668	7 06	2,835,[illegible]
Wisconsin	371,433	37 25	13,835,879	1,749,101	2 38	4,162,867	326,913	7 37	2,4[illegible]
Minnesota	151,242	38 53	5,827,351	134,170	2 32	311,274	150,795	7 38	1,112,867
Iowa	417,448	36 13	15,082,396	2,332,241	1 80	4,198,033	1,718,853	[illegible] 11	14,183,197
Kansas	109,142	30 67	3,347,385	107,896	2 62	282,687	137,848	6 82	940,193
Nebraska	42,071	41 00	1,724,911	22,059	2 71	59,779	65,637	6 39	419,420
California	214,318	50 31	10,782,338	2,200,400	2 53	5,567,012	429,007	5 52	2,368,118
Total	9,247,714		361,752,676	37,724,279		82,139,979	24,316,473		145,18[illegible],755
Grand average of prices		39.11			2.17			6 96	

EXPORTS OF WHEAT AND CORN.

The receipts from the export of cereals are of equal importance with those from the same value of cotton or cheese; and though they may be small in amount, they are not to be despised; yet the policy of growing grain for exportation, except as a pioneer expedient in opening and improving farms, is not to be commended. No material portion of our exports can ever be made up of breadstuffs, nor is it desirable that they should be. Grain exportation as a settled policy would soon so reduce the yield of cereals that there would be no surplus to export. The price of wheat in the distant west has been remunerative from the influx of settlers to be fed until the ripening of another crop, and from the markets opened among the miners of the mountains, rather than from exportation. It is the policy of this country, and its destiny, to bring consumers into the very fields of production, and to export surplus products of industry not in the bulky and burdensome form of raw material, but in products enhanced in value by the expenditure of labor, with a reduction to a minimum of the relative expenses of transportation.

That the comparative unimportance of the grain export may be seen at a glance the following tabulations have been prepared, showing the number of bushels of wheat and barrels of flour shipped to foreign ports since 1825, a period of forty-three years. In the first table the quantities are condensed into aggregates for periods of five years each:

Statement showing the quantity of wheat and flour exported from 1826 *to* 1855, *inclusive.*

Years.	Wheat, bushels.	Flour, barrels.	Total wheat and flour, in bushels.
Five years ending 1830	125, 547	4, 651, 940	23, 385, 247
Five years ending 1835	614, 145	5, 241, 964	26, 823, 965
Five years ending 1840	1, 842, 841	4, 092, 932	22, 307, 501
Five years ending 1845	2, 946, 861	6, 274, 697	34, 320, 346
Five years ending 1850	10, 184, 645	12, 284, 828	71, 608, 785
Five years ending 1855	16, 446, 955	13, 149, 518	82, 194, 545
Total in 30 years	32, 160, 994	45, 695, 879	260, 640, 389

Statement showing the quantity of wheat and flour exported from 1856 *to* 1868.

Years.	Wheat, bushels.	Flour, barrels.	Total wheat and flour, in bushels.
1856	8, 154, 877	3, 510, 626	25, 708, 007
1857	14, 570, 331	3, 712, 053	33, 130, 596
1858	8, 926, 196	3, 512, 169	26, 487, 041
1859	3, 002, 016	2, 431, 824	15, 161, 136
1860	4, 155, 153	2, 611, 596	17, 213, 133
1861	31, 238, 057	4, 323, 756	52, 856, 837
1862	37, 289, 572	4, 882, 033	61, 699, 737
1863	36, 160, 414	4, 390, 055	58, 110, 689
1864	23, 681, 712	3, 557, 347	41, 468, 447
1865	9, 937, 152	2, 604, 542	22, 959, 862
1866	5, 579, 103	2, 183, 050	16, 494, 353
1867	6, 146, 411	1, 300, 106	12, 646, 941
1868	15, 940, 899	2, 076, 423	26, 323, 014
Total	204, 781, 893	41, 095, 580	410, 259, 793
Total for 43 years	236, 942, 887	86, 791, 459	670, 900, 182

Statement showing the value of breadstuffs exported from 1826 to 1855, inclusive.

Years.	Wheat.	Flour.	All breadstuffs.
Five years ending 1830	[illegible]	[illegible]	$42,263,119
Five years ending 1835	[illegible]	[illegible]	[illegible]
Five years ending 1840	[illegible]	[illegible]	47,114,914
Five years ending 1845	[illegible]	31,056,156	51,705,513
Five years ending 1850	[illegible]	69,375,741	[illegible]
Five years ending 1855	[illegible]	75,775,220	134,181,567
Total in 30 years	[illegible]	[illegible]	[illegible]

Statement showing the value of breadstuffs exported from 1856 to 1868, inclusive.

Years.	Wheat.	Flour.	All breadstuffs.
1856	$15,115,661	$29,[illegible]	$59,010,219
1857	[illegible]	[illegible]	57,915,232
1858	[illegible],061,504	[illegible],328,884	35,569,068
1859	[illegible]	14,433,591	23,562,169
1860	[illegible]	15,[illegible]	26,989,709
1861	[illegible],313,624	24,645,849	73,534,544
1862	[illegible],573,295	[illegible]	[illegible]
1863	[illegible],754,195	28,366,069	[illegible]
1864	[illegible],432,133	25,[illegible]	[illegible]
1865	[illegible],397,197	27,[illegible]	[illegible]
1866	7,842,749	18,[illegible]	[illegible]
1867	7,[illegible]	12,[illegible]	[illegible]
1868	30,247,632	20,[illegible]	[illegible],046,187
Total in 13 years	[illegible]	[illegible]	[illegible]
Total in 43 years	317,841,124	[illegible]	1,193,555,748

A division of these results into decades makes the quantity and value of wheat and flour as follows:

Years.	Quantity.	Value.
	Bushels.	
Five years ending 1830	[illegible]	[illegible]
Ten years ending 1840	49,131,466	[illegible]
Ten years ending 1850	105,929,131	[illegible]
Ten years ending 1860	199,894,458	255,172,346
Eight years ending 1868	292,559,889	[illegible]
Total bushels	[illegible]	865,149,512

Statement showing the export price of wheat and flour.

Years.	Wheat, per bushel.	Flour, per barrel.
Ten years to 1840	$1 04	[illegible]
Ten years to 1850	[illegible]	5 41
Ten years to 1860	[illegible]	[illegible]
In 1861	[illegible]	5 79
In 1862	[illegible]	[illegible]
In 1863	[illegible]	[illegible]
In 1864	[illegible]	7 19
In 1865	[illegible]	[illegible]
In 1866	[illegible]	[illegible]
In 1867	[illegible]	[illegible]
In 1868	[illegible]	[illegible]

Thus in forty-three years our total exports of wheat have been 236,942,887 bushels, and of flour 86,791,459 barrels, making an equivalent in wheat and flour of 670,900,182 bushels of wheat, valued at $[illegible]5,149,512, an average of $1 29 per bushel.

For thirty years the average export was 8,688,012 bushels; for the last thirteen years, 31,558,445 bushels; for the whole period of forty-three years, 15,602,329 bushels; for eight years since 1860, 36,569,985, sold at an average of $1 40 per bushel, or $51,236,064. The receipts for these eight years have been $409,888,514, while the value of the exports of thirty-five years previous was but $455,260,998; the number of bushels sent abroad in eight years 292,559,880, against 378,340,302 in the prior period of thirty-five years. While the total exports bear a small proportion to the total amount produced, it is a significant fact that in a period of distraction and war, during a part of which a million of men were withdrawn from industry, as much wheat was sent abroad as in a preceding period of four-fold duration.

EXPORTS OF CORN.

The exports of corn, the great cereal of the country, and the distinguishing crop of the western world, present a meager showing, which will serve to illustrate the impolicy of reliance upon the foreign demand for maize as an aid to national industry.

Statement showing the quantity and value of exports of corn and corn meal.

Years.	CORN.		CORN MEAL.		TOTAL VALUE.
	Bushels.	Dollars.	Barrels.	Dollars.	Dollars.
Five years ending 1830	3,530,710	2,019,926	783,408	2,404,371	4,424,297
Five years ending 1835	2,568,946	1,804,711	817,383	2,731,077	4,535,788
Five years ending 1840	1,184,973	873,104	843,930	3,471,215	4,344,319
Five years ending 1845	3,474,109	1,755,602	1,132,749	3,037,021	4,792,623
Five years ending 1850	43,822,153	31,277,920	2,493,700	8,984,252	40,262,172
Five years ending 1855	23,905,196	17,712,699	1,121,456	4,147,318	21,860,017
Total in 30 years	78,486,087	55,443,962	7,192,626	24,775,254	80,219,216
1856	10,292,280	7,622,565	293,607	1,175,688	8,798,253
1857	7,505,318	5,184,666	267,504	957,791	6,142,457
1858	4,766,145	3,259,039	237,637	877,692	4,136,731
1859	1,719,998	1,323,103	258,885	994,269	2,317,372
1860	3,314,155	2,399,808	233,709	912,075	3,311,883
1861	10,678,244	6,890,865	203,313	692,003	7,582,868
1862	18,904,898	10,387,383	253,570	778,344	11,165,727
1863	16,119,476	10,592,704	257,948	1,013,272	11,605,976
1864	4,096,684	3,353,280	262,357	1,349,765	4,703,045
1865	2,812,726	3,679,133	199,419	1,489,886	5,169,019
1866	13,516,651	11,070,395	237,275	1,129,484	12,199,879
1867	14,889,823	14,871,092	284,281	1,555,585	16,426,677
1868	11,147,490	13,094,036	336,508	2,068,430	15,162,466
Total in 13 years	119,763,888	93,728,069	3,326,013	14,994,284	108,722,353
Total in 43 years	198,249,975	149,172,031	10,518,639	39,769,538	188,941,569

Statement showing the export of corn and corn meal in decennial periods.

Years.	Corn.	Corn meal.
	Bushels.	*Barrels.*
Five years, ending 1830	3,530,710	783,408
Ten years, ending 1840	3,753,919	1,661,313
Ten years, ending 1850	47,296,262	3,626,449
Ten years, ending 1860	51,503,092	2,412,798
Eight years, ending 1868	92,165,992	2,034,671
Total	198,249,975	10,518,639

The values of these exports in the decades named were as follows:

Five years, ending 1830.—Corn		$2,019,926	
	Corn meal	2,404,371	
			$4,424,297
Ten years, ending 1840.—Corn		2,677,815	
	Corn meal	6,202,292	
			8,880,107
Ten years, ending 1850.—Corn		33,033,522	
	Corn meal	12,021,273	
			45,054,795
Ten years, ending 1860.—Corn		37,501,880	
	Corn meal	9,064,833	
			46,566,713
Eight years, ending 1868.—Corn		73,938,888	
	Corn meal	10,076,769	
			84,015,657
Total value, corn and corn meal, exported in 43 years			188,941,589

The average export prices of corn for periods of ten years have been as follows:

Period.	Per bushel.	Per barrel.
Period ending 1840	$0 71¼	$3 73
Period ending 1850	69¾	3 31
Period ending 1860	72¾	3 76

The prices since 1860 have been as follows:

Years.	Per bushel.	Per barrel.
1861	$0 64½	$3 40
1862	55	3 07
1863	65¾	3 93
1864	81¼	5 14
1865	1 30	7 47
1866	82	4 76
1867	99¾	5 47
1868	1 17½	6 15

Converting corn meal to corn at four bushels to the barrel, the total amount of corn exports during forty-three years is two hundred and thirty millions bushels, or one-fourth of the crop of last year: and all the corn ever exported from this country could be replaced by one-third of that crop. For thirteen years past the annual average has been but ten millions of bushels annually, and for forty-three years five and a half millions, or one-eightieth part of the crop. During the entire period since 1825 an average of one bushel has been exported for every hundred produced.

The farmer who has harvested one thousand bushels has been depend-

ent upon the foreign demand to the extent of ten bushels, for which he may have received two dollars, while the price of thirty bushels has been expended in shipping it from the prairies to the markets of Europe. This is a very meager showing, but an export of ten times the amount would be worse, as a herald of the exhaustion and poverty that must result when so exhausting a crop is sent abroad at so great expense and little profit, and nothing returned to the depleted soil. An export of corn is therefore undesirable and unwise.

IMPORTS OF WOOLS AND WOOLENS.

The following is a statement of the imports of wool during the year ended June 30, 1868, as reported by the statistical bureau of the Treasury Department:

Description.	Quantity.	Value.
Wool, at 12 cents or less per pound	8, 907, 864	$972, 204
Wool, value over 12 cents per pound	10, 001, 697	1, 882, 482
Clothing wools, class No. 1, value 32 cents or less per pound	3, 068, 013	454, 204
Clothing wools, class No. 1, value over 32 cents per pound	31, 259	13, 042
Combing wools, class No. 2, 32 cents or less per pound	2, 109, 280	467, 661
Combing wools, class No. 2, over 32 cents per pound	6, 690	3, 063
Sheepskins, raw or unmanufactured, with the wool on, washed or unwashed	....	237, 589
Woolen rags, waste, shoddy, mungo, and flocks	556, 414	49, 649
Total	24, 681, 217	4, 079, 894

The imports of woolens for the same period are as follows:

		Quantity.	Value.
Cloths	pounds	4, 891, 975	$7, 139, 605
Shawls	pounds	158, 896	526, 272
All manufactures, wholly or in part of wool, not otherwise provided for	pounds	517, 618	750, 558
Flannels	pounds	28, 031	33, 037
Blankets	pounds	74, 586	35, 561
Hats of wool	pounds	84, 593	171, 757
Knit goods—hosiery	pounds	220, 356	482, 186
Knit goods—shirts, drawers, &c	pounds	79, 200	103, 665
Balmorals	pounds	18, 919	14, 756
Woolen and worsted yarns	pounds	407, 416	461, 417
Manufactures composed wholly or in part of worsted	pounds	....	1, 681, 194
Clothing and wearing apparel of every description, composed wholly or in part of wool or worsted	pounds	....	....
Ready made	pounds	59, 596	248, 419
Articles of wear	pounds	....	1, 082, 532
Webbings, beltings, bindings, braids, galloons, &c., of wool, worsted, or mohair, or of which either is a component material	pounds	357, 371	713, 415
Bunting		....	4, 957
Women's and children's dress goods, and real or imitation Italian cloths, wholly or in part of wool or worsted	sq. yards	60, 238, 332	15, 449, 787
Endless belts or felts for paper or printing machines		104, 967	100 070
Carpets, Aubusson and Axminster, and carpets woven whole for rooms		....	277, 486
Carpets, Saxony, Wilton, and Tournay velvet, wrought by the Jacquard machine	sq. yards	69, 513	143, 193
Carpets, Brussels, wrought by the Jacquard machine	sq. yards	536, 619	720, 343
Carpets, patent velvet and tapestry velvet	sq yards	251, 012	389, 163
Carpets, tapestry Brussels	sq. yards	1, 848, 497	1, 583, 374
Carpets, treble ingrain, three-ply, and worsted chain Venetian	sq. yards	26, 832	25, 703
Yarn, Venetian, and two-ply ingrain	sq. yards	74, 2[illegible]5	53, 084
Druggets and bockings, printed, colored, or otherwise	sq. yards	63, 977	28, 730
Carpets of wool not otherwise specified		....	151, 095
Total		....	$32, 371, 329

AGRICULTURAL EXPORTS.

Statement of the exports of agricultural products of the United States, with their immediate manufactures, for the year ended June 30, 1868.

Products and manufactures.	Quantity.	Value.
Animals, living—hogs .... number..	1, 399	$18, 447
Horned cattle .... number..	[illegible]	330, 163
Horses .... number..	[illegible]	143, 521
Mules .... number..	[illegible]	147, 7[illegible]
Sheep .... number..	[illegible]	83, 936
All other, and fowls .... number..	....	9, 540
Animal matter—guts, skins, bladders, &c	....	48, 295
Pork .... pounds..	[illegible]	3, [illegible]
Hams and bacon .... pounds..	[illegible]	5, 476, 998
Lard .... pounds..	[illegible]	9, 427, 831
Lard oil .... gallons..	[illegible]	330, 17[illegible]
Neat's-foot and other animal oils .... gallons..	[illegible]	23, 433
Beef .... pounds..	[illegible]	2, 696, 011
Poultry	....	1, 484
Preserved meats	....	75, 226
Tallow .... pounds..	[illegible]	2, 540, 227
Hair, unmanufactured	....	79, 642
Hair, manufactured	....	[illegible]
Butter .... pounds..	[illegible]	[illegible]
Cheese .... pounds..	[illegible]	7, 010, 424
Eggs .... dozens..	[illegible]	5, [illegible]
Candles, tallow, &c .... pounds..	2, 975, 517	533, 095
Soap, perfumed	....	5, 171
Soap, other .... pounds..	7, 3[illegible], 231	621, [illegible]
Glue .... pounds..	[illegible]	4, 346
Stearine .... pounds..	207, 700	22, 280
Wax .... pounds..	[illegible]	255, 365
Leather .... pounds..	2, 47[illegible]	601, 175
Leather, morocco and other, fine	....	5, 930
Leathern boots and shoes .... pairs..	363, 419	578, 650
Leathern saddlery and harness	....	97, 393
Leathern manufactures not specified	....	131, 224
Wool .... pounds..	558, 435	191, 119
Manufactures of wool not specified	....	206, 879
Furs and skins	....	1, [illegible]
Bones and bone dust .... cwt..	6, 172	9, 678
Bone-black, ivory-black, &c .... pounds..	155, 258	12, [illegible]
Breadstuffs—indian corn .... bushels..	11, 147, [illegible]	13, 094, 036
Indian meal .... barrels..	[illegible]	2, [illegible]
Wheat .... bushels..	[illegible]	30, 247, 632
Wheat flour .... barrels..	[illegible]	20, 887, 798
Rye .... bushels..	[illegible]	[illegible]
Rye flour .... barrels..	10, 592	[illegible]
Barley .... bushels..	9, 810	[illegible]
Other small grain and pulse	....	[illegible]
Rice .... pounds..	[illegible]	[illegible]
Bread and biscuit .... pounds..	[illegible]	649, 492
[illegible], and all other preparations from breadstuffs	....	[illegible]
Cotton, [illegible] .... pounds..	[illegible]	3, 023, 334
Cotton, [illegible] .... pounds..	[illegible]	14[illegible]
Cotton manufactures, [illegible] .... yards..	[illegible]	531, 669
Cotton manufactures, [illegible] .... yards..	[illegible], 177	1, 551, 339
[illegible]	....	2, 788, 646
Wood, [illegible]—boards, planks, and scantling .... M feet..	131, 873	2, 806, 229
[illegible]	....	177, 010
[illegible] .... tons..	75, 720	[illegible]
[illegible]	....	12, 427
[illegible]	....	[illegible]
[illegible]	....	1, 3[illegible]
[illegible] .... M..	31, 466	139, 549
[illegible] for barrels and hogsheads	....	3, 393, 884
[illegible]	....	680, 137
[illegible] .... M..	20, 955	2, 377, 792
[illegible] .... number..	177, 614	288, 047
[illegible] .... M..	16, 930	821, 949
[illegible]	....	217, 174
[illegible]	....	1, 199, 160
[illegible] not specified	....	[illegible]
Ashes, pot and pearl .... cwt..	22, 030	256, 330
Rosin and turpentine .... barrels..	443, 501	2, 028, 514
Tar and pitch .... barrels..	26, 751	110, 641
Apples, green or ripe .... bushels..	54, 654	94, 748
Apples, dried .... bushels..	31, 028	121, 910
Fruit, green, ripe, or dried, not specified	....	189, 854
Potatoes .... bushels..	378, 605	483, 325
Onions .... bushels..	60, 849	79, 187

Statement of the exports of agricultural products, &c.—Continued.

Products and manufactures.	Quantity.	Value.
Pickles and sauces		$29, 094
Vegetables, prepared or preserved		16, 720
Vegetables, not specified		169, 692
Clover seed .... bushels..	2, 645	11, 193
Flax seed .... bushels..	44	332
Linseed oil .... gallons..	16, 650	21, 545
Castor oil .... gallons..	6, 385	13, 645
Essential oil		173, 656
Oil cake .... pounds..	115, 523, 977	2, 913, 448
Hemp, unmanufactured .... cwt..	141	2, 193
Manufactures of hemp—bags		9, 154
Cables and cordage .... cwt..	15, 491	331, 238
Hemp cloth		1, 594
All other manufactures of hemp		250, 631
Hops .... pounds..	522, [illegible]	264, 129
Hay .... tons..	5, 645	118, 443
Ginseng .... pounds..	370, 066	380, 454
Salt .... bushels..	624, 970	289, 936
Beer, ale, porter, and cider, in bottles .... dozens..	1, 387	3, 603
Beer, ale, porter, and cider, in casks .... gallons..	79, 006	30, 372
Spirits, distilled from molasses .... gallons..	1, 142, 553	491, 601
Spirits, distilled from grain .... gallons..	574, [illegible]	325, 651
Spirits, distilled from other materials .... gallons..	1, 061, 133	598, 869
Spirits of turpentine .... gallons..	3, [illegible], 029	1, 627, 577
Wine .... gallons..	27, 070	33, 564
Molasses .... gallons..	42, 543	21, 691
Vinegar .... gallons..	60, 963	17, 530
Sugar, brown .... pounds..	3, 943	609
Sugar, refined .... pounds..	2, 214, 2[illegible]7	313, 378
Candy and confectionery		12, 901
Cigars .... M..	1, 870	70, 350
Snuff .... pounds..	11, 393	8, 730
Tobacco, manufactured .... pounds..	10, 470, 024	3, 100, 084
Leaf tobacco, unmanufactured	206, 020, 504	22, 898, 823

RECAPITULATION.

Animal production	$37, 626, 063
Breadstuffs	69, 089, 249
Cotton and its manufactures	157, 691, 787
Wood and its products	17, 761, 755
Miscellaneous	35, 520, 924
Total	317, 689, 778

IMMIGRATION.

Since the organization of our government, eighty years ago, a people of three millions, of European extraction, have become forty, not altogether by natural increase, but in part by immigration, in a rippling stream at first, which has gathered volume until its current is equivalent to a third of a million annually, and its total aggregation eight millions. It is one of the marvels of the eventful nine years since 1860, that one-fourth of all the immigrants who have ever sought our shores have come during the frightful civil war or since its close. Two millions of human beings, two-thirds as many as fought the war of the revolution, have thus been added to our numbers since the taking of the last census.

The records of immigration from 1820 to 1860 present an aggregate of 5,459,421 passengers arrived. From 1790 to 1820 about 200,000 arrivals were reported or estimated. About one-seventh of these returned, and perhaps as many were received through Canada. Of all these numbers, three-fifths were males, and one-half were in the vigor of youth, between the ages of fifteen and thirty.

Of the numbers arriving between 1820 and 1860, 2,750,874 were from Great Britain, of whom 967,366 were from Ireland; and 1,486,044 came

from Germany. Thus the same Anglo-Saxon elements, constituting the bulk of our original population, enter in nearly the same proportions into the accretions gained by annual immigration.

More than a million of these immigrants were children; the numbers with occupations not noted were 2,978,599; there were 764,837 farmers, and 872,517 laborers, many of whom either immediately or ultimately became farm laborers or farmers. It is evident that more than half of all these immigrants became cultivators of the soil.

During the past nine years the arrivals of immigrants make an aggregate of 2,141,403—886,545 from Great Britain, (Ireland, 390,032;) Germany, 616,268; British America, 87,602; China, 46,681. Every quarter of the globe has been represented, even Africa and the isles of the Pacific. Among the African countries contributing are Abyssinia, Egypt, Liberia, and South Africa; among the islands of the Pacific, New Zealand, Australia, the Society and Sandwich islands; and the immigration from Iceland includes eleven souls.

The German immigration has been large since the war, amounting to 343,183, and the total for four years past exceeds the aggregate numbers of the nine previous years. The largest influx from Great Britain was in 1866—131,629 immigrants; and the largest from Ireland was 69,977, in 1867. The greatest movement from Germany was also in 1867, numbering 121,240. In the last ten years the total numbers, in he order of their magnitude, were as follows: 1866, 359,943; 1867, 333,627; 1868, 326,232; 1865, 287,399; 1864, 221,535; 1863, 199,811; 1860, 179,691; 1859, 155,509; 1862, 114,463; 1861, 112,702.

The following statement of the occupations of immigrants of the past thirteen years, from 1856 to 1868 inclusive, is obtained from the Treasury Bureau of Statistics:

Occupations of immigrants.

Occupations.	1856.	1857.	1858.	1859.	1860.	1861.	1862.
Laborers	37,019	43,249	22,317	21,696	31,268	19,413	17,752
Farmers	24,722	34,702	20,566	16,323	21,742	11,668	9,265
Mechanics	[illegible]	18,074	11,995	13,092	13,023	7,575	6,934
Merchants	11,101	12,114	10,217	12,495	11,207	7,523	7,763
Miners	6,136	5,660	4,254	9,510	3,834	2,337	1,732
Servants	1,748	1,322	1,142	1,281	1,415	770	3,704
Mariners	906	990	1,109	826	1,607	734	1,624
Clerks	135	271	259	194	200	122	658
Bakers	19	51	74	46	104	28	183
Butchers	54	22	38	38	58	27	194
Seamstresses and milliners	215	258	261	250	273	49	182
Physicians	163	147	178	253	221	216	236
Artists	37	69	45	97	80	31	88
Clergymen	118	173	132	157	183	213	274
Weavers and spinners	1,255	189	80	114	141	43	57
Tailors	25	103	156	137	204	41	66
Shoemakers	22	86	117	141	156	383	85
Lawyers	90	78	113	166	116	106	108
Manufacturers	22	187	74	62	50	218	94
Engineers	105	72	165	118	132	98	97
Teachers	25	22	46	86	57	22	19
Masons	10	16	68	40	59	22	21
Millers	73	26	39	37	48	29	21
Musicians	15	31	115	45	[illegible]	26	14
Actors	4	41	33	54	27	5	17
Painters	1	31	31	15	29	11	3
Printers	12	21	19	8	14	12	22
Hatters	2	....	3	....	....	1	1
All other occupations	662	246	551	609	825	218	[illegible]
Occupations not specified	[illegible]	153,717	[illegible]	77,619	[illegible]	[illegible]	[illegible]
Aggregate	224,496	271,982	144,906	155,509	179,691	112,702	114,463

Occupations of immigrants—Continued.

Occupation.	1863.	1864.	1865.	1866.	1867.	1868.	Total.
Laborers	46, 198	48, 041	45, 245	58, 629	55, 443	68, 947	515, 217
Farmers	12, 349	13, 837	20, 012	30, 302	29, 717	19, 804	264, 949
Mechanics	14, 418	14, 156	20, 218	23, 939	25, 966	17, 298	196, 503
Merchants	7, 582	9, 468	12, 676	15, 834	11, 841	8, 393	138, 214
Miners	4, 314	6, 093	7, 631	8, 010	7, 205	4, 698	71, 414
Servants	9, 088	15, 629	9, 236	8, 905	6, 367	8, 021	68, 628
Mariners	2, 088	2, 106	2, 518	2, 687	2, 501	1, 892	20, 988
Clerks	1, 277	1, 574	2, 775	2, 731	2, 317	1, 351	13, 864
Bakers	520	647	1, 003	966	988	751	5, 380
Butchers	403	545	842	840	974	623	4, 658
Seamstresses and milliners	347	640	304	373	336	282	3, 770
Physicians	284	515	399	521	438	365	3, 736
Artists	377	340	606	662	661	468	3, 561
Clergymen	231	258	374	453	454	302	3, 322
Weavers and spinners	347	130	143	135	156	76	2, 866
Tailors	75	147	366	322	299	205	2, 151
Shoemakers	73	148	209	272	250	186	2, 128
Lawyers	156	132	249	359	252	17	1, 942
Manufacturers	66	107	181	254	198	183	1, 696
Engineers	95	86	100	142	111	24	1, 345
Teachers	16	29	59	142	33	237	809
Masons	31	37	77	132	184	102	799
Millers	5	24	40	54	65	36	497
Musicians	7	12	10	21	32	14	450
Actors	15	20	18	47	94	....	378
Painters	27	29	43	65	60	18	363
Printers	15	19	20	44	22	19	247
Hatters	....	1	1	12	4	1	26
All other occupations	360	308	455	648	437	426	5, 984
Occupations not specified	99, 047	106, 657	161, 589	202, 442	192, 222	191, 493	1, 602, 411
Aggregate	199, 811	221, 535	287, 399	359, 943	339, 627	326, 232	2, 938, 296

SUGAR PRODUCTION IN LOUISIANA.

Louisiana continues to be the main source of sugar production in the United States, though the Gulf coast, from Florida to Texas, is beginning to be dotted with sugar plantations, from which little income has, as yet, been derived. At the present time the business stands high in popular appreciation.

In Louisiana, production has been wonderfully stimulated by the high price of the product. The severe frost on the 29th of January everywhere injured the rattoons very severely, though the seed cane escaped; and with favorable weather, producing an extraordinary growth, a large crop was anticipated, until October 2, when the cane was prostrated by a severe storm of wind; bad weather intervened, delay in obtaining fuel occurred, frosts injured the outlying cane, election excitements interfered with labor, a series of unusual misfortunes combined to diminish the total production of the year; yet an aggregate of 84,256 hogsheads was reached, or 95,051,225 pounds, and 6,081,907 gallons of molasses, against 37,647 hogsheads in 1867. This result was attained, notwithstanding the loss of 8,000 acres of cane totally lost.

A local census of this important crop, made by Mr. L. Bouchereau, the facts of which he has communicated to this Department, affords abundant evidence of energy and progress in this branch of agricultural production.

The acreage in cane was about 63,199, and the average yield 1,504 pounds of sugar and 80 gallons of molasses. A larger proportion of molasses than usual is due to the injury of the crop by the weather, which rendered its use for sugar impracticable. The total number of sugar-growers was 747; sugar-houses in operation, 673; portable mills, 8; steam-power sugar-houses, 540; horse-power sugar-houses, 133; open kettles, 567; open pans, 60; vacuum pans, 46; board and slate sugar-

houses, 85; board and shingle sugar-houses, 231. The following is a revised statement of production since 1862 and 1863, of which years no report is made, showing the rate of recuperation since the war:

	Hogsheads.
1864	6,668
1865	15,500
1866	41,000
1867	37,647
1868	84,256

THE GREAT STOCK MARKETS.

RECEIPTS OF LIVE STOCK AT NEW YORK IN 1868.

The following table exhibits the receipts of live stock at New York in the years 1866–'67–'68.

Year.	Beeves.	Cows.	Calves.	Sheep.	Swine.	Total.
1866	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,062,894
1867	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,643,939
1868	[illegible]	[illegible]	[illegible]	[illegible]	976,511	2,758,552

The weekly average of 1868 is as follows: beeves, 5,637; calves, 1,595; sheep, 26,955—an increase of 2,000 over the average of the previous year; swine, 18,779. The following are the average prices for the year: beef, 15¾ cents per pound; sheep 6 cents; hogs, 9¼ cents. In beeves an average advance is shown over the previous year of one-fourth to one-half cent per pound. In sheep, a slight diminution of price, owing to large increase in supply. There was a considerable decrease in the supply of hogs which ruled two to three cents per pound higher than in 1867, the advance being quite three cents at the close of the year. The decrease in number amounts to 126,000 head for the year. The following is an exhibit of sources of supply of beef cattle: Illinois, 165,668; New York, 28,757; Ohio, 27,303; Kentucky, 19,372; Indiana, 14,655; Texas, 11,900; Missouri, 9,781; Pennsylvania, 3,455; Canada, 3,068; Iowa, 2,950; Connecticut, 2,705; Michigan, 1,506; West Virginia, 1,046; Kansas, 818; Nebraska, 263; Massachusetts, 249; New Jersey, 200.

There has been but little variation in the average price of beeves for the last three years. In 1868 they brought the highest price in April, running up to an average of eighteen cents in the early part of the month, and were at their lowest in October and November, reaching an average of thirteen and a half cents. In January, the prices of the different qualities ranged from eleven to twenty cents; in December, from eight to twenty cents. Sheep brought the highest prices in April, at an average of eight cents for the month; and the lowest price in October, when the receipts averaged nearly 15,000 head per week. At the last of the month prices ranged from three and a half to five cents.

BOSTON LIVE STOCK MARKETS, 1868.

The numbers of live stock sold in the Boston markets during 1868 are as follows: cattle, 110,010; calves, 13,700; sheep, 492,735; hogs, 127,544; pigs, 10,443. The sources of supply of cattle are as follows: Maine,

10,574; New Hampshire, 7,209; Vermont, 18,426; Massachusetts, 2,780; New York, 4,327; Western States, 61,689; Canada, 5,005. Sources of supply of sheep: Maine, 9,174; New Hampshire, 41,965; Vermont, 173,802; Massachusetts, 18,390; New York, 39,683; Western States, 167,410; Canada, 42,401.

The number of cattle for 1868 was somewhat greater than that of 1867, but less by about 8,000 head than the exhibits of 1865 and 1866. Comparison of sales of sheep during the six years from 1863 to 1868 shows a greater amount for the last named than for any of the five previous years. The excess of 1868 over 1867 was 70,795 head.

The best beef brought thirteen and a half to fourteen and a half cents during January. During the subsequent months, fifteen to sixteen cents. From June, prices declined till the first of September, after which they ranged, for the most part, from twelve and a half to thirteen and a half cents. The lower grades varied much more in price. During the fall, grass-fed cattle were sold at seven to nine cents per pound, while during the spring and early summer there were several weeks when scarcely any animals were to be bought short of twelve to thirteen cents per pound.

RECEIPTS OF CATTLE IN CHICAGO, 1867-'68.

Source of supply.	1868.	1867.
Illinois Central Railroad	60,902	58,882
Rock Island Railroad	35,616	41,241
Michigan Central Railroad	2,215	1,466
Pittsburg and Fort Wayne Railroad	444	439
Great Eastern Railroad	1,392	1,347
Alton and St. Louis Railroad	64,952	54,143
Burlington and Quincy Railroad	108,901	119,931
Northwestern Railroad	46,758	50,189
Michigan Southern Railroad	796	1,050
Driven in	2,548	5,500
Total	324,524	334,188

Of the receipts of 1868, one-third, or 108,901, were transported by the Burlington and Quincy road, which runs through a fine cattle region, and connects with the railroads of Northern Missouri. The Alton and St. Louis, passing in the same direction through the State, and also leading to Missouri, brought the next largest number, 64,952; the Illinois Central contributed 60,902; the Northwestern, (through Wisconsin,) 46,758; and the Rock Island, 35,616.

The receipts of Texas cattle in Chicago, during 1867, was about 35,000 head; during 1868, about 55,000 head. The price in August averaged $3 72 per 100 pounds; in September, when they were sold with difficulty, generally by the head, at $24 to $32 each; in November, $3 93 per 100 pounds. At the same time Texas cattle wintered at the north realized $4 25 to $6 50 per 100 pounds.

Prices of beef cattle and live hogs.—The prices obtained averaged as follows: Best fat shipping cattle, $7 26 to $7 98 per 100 pounds; steers in good flesh, weighing 1,150 to 1,250 pounds, $6 14 to $6 65; steers weighing 850 to 950 pounds, $4 48 to $5 08; stock cattle, $3 83 to $4 32; cows and heifers, $3 78 to $5 78.

The receipts of live hogs in 1868 were 1,705,433, according to Mr. Griffeth's register, and the shipments 1,020,329. The total of weekly sales was 1,786,675, averaging 223 pounds.

The mean annual range of prices of beef cattle and of live hogs, as

gathered from the review of the Chicago stock trade in the Live Stock Reporter, for the past six years, are as follows:

Year.	BEEF CATTLE.		LIVE HOGS.	
	In currency.	In gold.	In currency.	In gold.
1863	$2 33 to $4 80	$1 67 to $3 29	$3 11 to $5 00	$2 16 to $3 44
1864	2 56 to 7 52	1 26 to 3 61	5 94 to 9 80	2 87 to 4 74
1865	2 94 to 8 46	1 90 to 5 49	8 81 to 11 55	5 66 to 7 40
1866	3 33 to 7 72	2 40 to 5 46	7 87 to 9 47	5 58 to 6 80
1867	3 52 to 8 02	2 55 to 5 81	4 76 to 7 01	3 44 to 5 06
1868	3 44 to 8 10	2 45 to 5 79	6 72 to 9 40	4 80 to 6 72

PRICES OF BREADSTUFFS AT NEW YORK.

The following averages of prices, at the dates named, show the great decline in breadstuffs during the year 1868:

		April 24, 1869.	April 25, 1868.
Flour—superfine	per bbl.	$5 45	$9 70
extra State	do.	5 95	10 60
shipping Ohio	do.	6 15	10 70
extra western, common to good	do.	5 85	10 33
double extra western and St. Louis	do.	8 95	13 88
southern superfines	do.	6 45	10 78
southern extra and family	do.	9 13	13 25
California	do.	8 50	13 63
Rye flour	do.	5 73	8 88
Corn meal	do.	4 48	6 00
Wheat—spring	per bushel.	1 38	2 58
red winter	do.	1 55	2 85
amber winter	do.	1 71	2 95
white	do.	1 83	3 20
Corn—western mixed	do.	83	1 18
yellow	do.	85	1 23
white	do.	86	1 15
Rye	do.	1 33	2 15
Oats—western	do.	73	86

The results of statistical researches upon special subjects, are presented in other pages of this volume, and a variety of important matter, not yet sufficiently full or complete, is withheld for use in future publications.

J. R. DODGE.

Hon. H. CAPRON,
Commissioner.

REPORT OF THE CHEMIST.

SIR: In making a report of the work done in the laboratory during the past year, it is proper to mention that the removal of the department to its present location necessarily led to the suspension of chemical work for two months as regards most analyses, and for a much longer period on dry methods, owing to delay in completing the arrangement of the furniture of the laboratory apartments. The necessary preparations for removal also forbade entering on any extended course of analyses: hence the laboratory has been chiefly occupied, during the year, with the performance of analyses of agricultural substances used as manure, and in satisfying immediate demands for information made by correspondents. The total analytical work in the laboratory for the year embraces the following classes, viz:

1. Marls, including varieties both recent and fossil.
2. Earths, clays, slates, and soils.
3. Ores of gold, silver, iron, manganese, tin, nickel, &c.
4. Wines from different States.
5. Mineral waters.
6. Pharmaceutical preparations.
7. Cases of suspected criminal poisoning requiring analysis.
8. Artificial fertilizers.
9. Many mineral determinations.
10. Proximate analyses of plants for technical purposes.

The work has been confined very strictly to supplying the demands of practical agriculture, consisting principally of analyses of marls, soils, and vegetables; and to the examination of deposits newly opened which promise to be sources of local wealth. In carrying out the latter, it is found difficult to avoid subserving private interest while seeking public good. The opinion being somewhat prevalent that this department should constitute itself the official examiner of all manures in the market, both natural and artificial, samples of fertilizers suspected of adulteration, obtained from merchants and traders, have been forwarded for analysis. Such correspondents have been informed that the laboratory of this department is devoted to the analysis of soils, waters, and natural manures, such as peat, marls, &c., and other matters of State or public interest. It does not make analyses of commercial manures, as guano, bones, superphosphates, &c., either for the farmer or the manufacturer. The department does not perform any work which has for its object the establishment of works or manufactures of private enterprise

A chemical laboratory is necessarily incomplete, for the purposes of industrial analysis of materials useful to the farm or to commerce, without a museum of typical specimens embraced within the scope of work of this division, and it is deemed desirable that such should be formed. Already, through the correspondents of the departments, valuable specimens of geological strata, building materials, limestones, and other illustrations of the economic wealth of the country, have been collected, and more might readily be obtained through the same agencies. These specimens will form, when catalogued and displayed, a very valuable and interesting collection, not represented in other museums, and having for its object the exposition of the industrial and the techno-

logical value of the mineral wealth of the country rather than purely scientific relations. To carry out this plan would involve some expenditure for the fitting up of necessary shelving, &c., for the specimens.

GREENSAND MARLS.

Of the mineral analyses performed during the year those of marls much exceeded all others. These marls were not those of the alluvial, or, as it is sometimes called, quaternary formation, as the name might imply; but were derived either from the cretaceous or the tertiary; and, as many greensand marls from Maryland and Virginia were among the number, some remarks concerning them, as regards their pecularities and contrast with other beds of same age further north, may not be out of place.

THEIR POSITION AND GEOLOGICAL RELATION.

The greensand beds of the Atlantic States are a very important geological formation, whether we consider them as occupying a large tract of country or as affording a valuable amendment to the soil which they underlie. Extending in a gentle and continuous curve along the seacoast, they are found in every coast State from the Hudson River to the Mississippi. The beds have a very general trend north-northeast and south-southwest, and a similar dip, being about twenty feet to a mile in New Jersey, and almost precisely the same in Mississippi: showing a great uniformity in the causes which led to their deposition and elevation, and in the conditions governing them. Occurring at the close of the cretaceous period, owing to the absence of cementing material originally present, or subsequently percolating, they have never consolidated, and are still beds of sand, (clayey and calcareous sand,) differing in no physical respect from the alluvial and later beds, which cover them to the depth of several feet

Although the lithological character of the beds is not the same in the northern and the southern extremity of the deposits exposed, yet their identity can be at all times recognized by the fossil shells most abundantly present, and which are by far the most uniform in occurrence. When the manner of deposition of this sand over so large a tract of country is examined, it is found that the amount of material varies considerably in thickness, generally diminishing the further south it is examined.

In New Jersey these marl beds occupy a very narrow belt of land from four to sixteen miles wide, from the ocean shore near Sandy Hook (New York Bay) to Salem, on the Delaware. A sandy soil, destitute of diluvium, covers the region, which has a strike south 55° west, and a dip southeast about twenty feet per mile. This formation is composed of six beds, three of which are true greensand layers, and three are beds of marine sand separating the others. In Maryland and Virginia it is probable that these three beds or their equivalents may exist, but they have not been accurately distinguished: and in North Carolina but two of the three have been recognized, the lower bed being formed at Black Rock, and the upper bed at Tarborough, on Tar River, at Colonel Clark's. In the latter place the shell bed, containing pecten, exogyra, belemnites, lignite, and pyrites, is found immediately over the stratum of greensand, which is confined to one bed, or at most to two. In Mississippi but one bed is found as the representative of the three of New Jersey; nor does this single bed exceed in thickness a single bed of the New Jersey deposit.

So much has been already written about the greensand beds of New Jersey that but little is needed to be inserted here. Being the first deposits of this character used as a fertilizer for the soil, and the demand increasing more than the yield, it has for some years back been an article of marketable transport on railways, and is acknowledged to be second to no other mineral fertilizer when it is considered how long a dressing of it is felt upon the land. In that State the greensand is in places, as in Burlington County, mixed with a dark chocolate-colored clay; in Monmouth County generally with a lighter clay and some shells. In beds more to the south the sand increases in amount, while in a few beds here and there the marl appears to have undergone but little mixture with clay or sand, but is almost wholly composed of the green grains which have given the name of greensand to the whole formation. Until lately the great value of this fertilizer was attributed to its constituent potash; but it is now admitted that its value is not due to this source alone, and that it must be shared with phosphoric acid and other constituents. As the pure greensand grains (glauconite) are valuable portions of this manure, efforts have been made, both in this laboratory and elsewhere, to ascertain their exact chemical composition. The variable results are not owing to any intrinsic difficulty in analysis, but to the extreme difficulty of procuring samples sufficiently clean and free from foreign matters for operating upon. By washing and sifting, even though performed many times, it is almost impossible to obtain the green grains perfectly free from admixture with sand and sulphate and also phosphate of lime. This difficulty is mentioned in the final report of the Geological Survey of New Jersey, (1868.) in which appear several examples of analysis of these marls, apparently performed with care, industry, and chemical skill. On page 281 of that report the following occurs as one of the averages of the composition of glauconite:

Silica	50.923
Peroxide of iron	19.353
Alumina	7.503
Protoxide of iron	3.909
Magnesia	2.918
Potash	7.505
Water lost at 212° / Water lost at above 212°	7.889
	100.000

The potash in other analyses varied, running from 7.262 to 9.087 per cent. The analyses excludes all the lime, salts, and the silica in the marl from the constitution of the glauconite, the chief agricultural value of which had been estimated to lie in its potash constituent. The iron exists in both states of oxidation as protoxide and peroxide. The amount of greensand grains present in the various marls of New Jersey ranged from 16 per cent. to 90—from 25 to 33 per cent. being the average of many. It is worthy of remark how small an amount of glauconite gives a blue tint to clay or sandy clay—less than 4 per cent. giving a very decided shade of blue.

The foregoing, however, does not represent the true composition or the actual value of the greensand of New Jersey as it is used. In the second annual report of the Geological Survey of that State, 1856, pp. 85–91, several analyses of the greensand marls are given, in all of which two ingredients, additional to those described as entering into

glauconite, are set down—sulphuric and also phosphoric acid—the latter of which exists in notable proportion.

Squankum marl yields of phosphoric acid	4.54	per	cent.
Pemberton, (No. 1)	1.68	"	"
Pemberton, (No. 2)	2.39	"	"
Clementon	2.64	"	"
Freehold	1.93	"	"
New Egypt	1.58	"	"
Blackwoodtown	3.66	"	"
Woodstown	2.65	"	"
Marlborough	1.14	"	"
Shelltown	0.17	"	"

The last named is from the clay which underlies the marl, and which, though green in color, contains but few green grains. This phosphoric acid in some specimens exists as phosphate of lime; in others, as phosphate of iron. The latter probably was its original combination. The presence of pyrites and vegetable matter results in the formation of sulphuric acid, which, acting in the iron phosphate and on the lime carbonate of the shelly portion, liberates the phosphoric acid of the first and unites with the lime of the second; the free phosphoric acid then acts on some lime carbonate to form phosphate of lime. Thus both sulphate and phosphate of lime are introduced into the marl. But whence is the origin of the phosphate of iron? The glauconite does not appear to furnish sufficient to account for the amount given above; indeed, the usual analyses of pure glauconite do not mention phosphoric acid as a constituent. It is assumed by Professor Cook that the phosphate of lime of these sands is a foreign ingredient, and no necessary part of glauconite. "In fact," he states, "the phosphate of lime can easily be distinguished by the eye from the greensand grains with which it is mixed. It does not form any necessary part of the mineral, and may be rejected from the analysis."

The fact of the universal presence of phosphate of lime in the green sand is certainly no proof of its origin in the glauconite; but that the phosphate of lime may be detected by the eye in the mass of the marl as distinct from the green sand has not been verified in the examination of marls in this laboratory. Indeed, the reverse has generally been demonstrated. From a carefully conducted chemical analysis, made in this laboratory by the assistant chemist, Dr. Tilden, upon a sample of greensand marl from Upper Marlborough, Maryland, which contained on an average 50 per cent. of fine angular quartz sand as its only visible admixture, there were found in one hundred parts 1.53 parts of anhydrous phosphoric acid, equivalent to 7.44 per cent. of the probable ferroso-ferric phosphate. The phosphoric acid had not been united with lime in the marl, and must have existed as a phosphate of iron; and, if not a constituent of the glauconite, was present as a phosphatic earth commonly found in this geological formation, and is the parent of the vivianite occasionally found in the stratum.

In the State of Delaware the greensand beds are found crossing its northern border in their course from New Jersey into Maryland. Repetitions of the beds occur in the ravines of St. George's Creek, where the chemical composition is carbonate of lime, greensand, and white silicious sand. Along the line of the canal west of St. George's the bed has yellow clay and micaceous clay mixed with the greensand, giving different shades of color to the bed. The southern limit is near Cantwell's Bridge, where the marl is found to be mixed with yellow clay, and is

much more ferruginous than elsewhere. In St. George's Hundred a bed of bluish green sand is met with, which is described by Professor Booth, who is the authority here quoted, as being nearly pure glauconite, and yielding, on an analysis:

Silica	55.77
Potassa	9.00
Lime and magnesia	2.30
Protoxide of iron	21.70
Alumina	3.12
Water	8.50
	100.39

The presence of the lime and magnesia shows that calcareous detritus has crept into this specimen. The bright green sandy marl of Drawyer's Creek furnishes, on analysis, a nearer approach to the glauconite composition:

Silica	56.35
Potassa	8.418
Protoxide of iron	22.25
Alumina	6.00
Water	7.11
	100.128

Classing the Delaware greensand in two deposits, the calcareous and the glauconitic, which are separated by a bed of yellow sand or sandy clay, it is found that these beds occasionally merge together and separate again. This has been observed in sections of the canal in Delaware. The same occurrence is met with in river cuts in North Carolina. The chemical composition of the beds of course varies in proportion as either the calcareous or glauconitic element preponderates. This is well seen in the analyses of the upper and the lower greensand deposit of Delaware, made by Professor Booth, in which the lime may be taken as the varying substance.

Greensand of Delaware.—(Booth.)

Upper Beds.	No. 1.	No. 2.	No. 3.	No. 4.
Carbonate of lime	18.6	24.7	20.13	58.60
Green sand	33.0	35.0	38.00	6.00
Silicious sand	35.0	31.0	32.00	35.40
Clay	14.0	9.0	10.00	....
	100.6	99.0	100.13	100.00

Lower Beds.	No. 5.	No. 6.*	No. 7.
Lime and magnesia	2.30	....	....
Protoxide of iron	21.70	22.21	27.02
Potash	9.00	8.50	5.37
Silicious sand	55.77	56.70	52.60
Alumina	3.12	5.00	7.70
Water	8.50	9.30	7.40
	100.39	101.00	100.09

* Contained shark's teeth.

The average thickness in Delaware is about twenty-one feet, increasing in the south to twenty-five feet. The highest amount of carbonate of lime which has been found in the calcareous greensand of this State is twenty-five per cent. These beds enter Maryland from Delaware at the head of Appoquinemink Creek, or near the head of the Sassafras in Kent County, whence it crosses the Chesapeake into Anne Arundel County and Prince George's. In the latter it approaches the line of the District of Columbia, occurring at Marlborough in beds ten to twelve feet thick; thence it passes south through Charles County below Chicomoxen Creek, and enters Virginia at Aquia Creek, in Stafford County. The marls in Maryland and Virginia may properly be considered in this place, as, although not presenting the characters of the true greensand beds, yet they bear a close relation to those found in New Jersey and Delaware. From the samples of all of these marls forwarded from these two States to the department for examination, it would appear that, excepting the beds near upper Marlborough, the strata belong to the lower eocene, as is shown by the fossils occurring through them. They resemble the Delaware marls in the large amount of carbonate of lime which they contain, clearly showing their geological position to be in the cretaceous or chalk formation. This carbonate of lime it not always evident as whole shells or fragmentary portions; but, even when not distinct to the naked eye, constitutes a portion of the mass as a finely coherent powder, so that every stratum of these greensands may be roughly stated as made up of—

1. Chalk powder.
2. Greensand grains, or glauconite.
3. Whitish quartzose sand.

Of these the latter element is the most constant; for though it may be found that the bed of one locality differs from the same bed in another in containing less glauconite, yet there is not therefore present more chalk or carbonate of lime. It is then usually found to be more sandy, while sometimes, instead of the whitish quartz grains increasing, a greenish or bluish micaceous sand takes its place. The amount of the glauconite varies, but rarely ever approaches one-third of the whole. More frequently it is less than ten per cent., and in most of those in Prince George's County and Charles's it seldom exceeds three per cent., as shown by elutriation. When this mineral is in so small amount, of course the marl does not pay for its distant transportation; but it is still a benefit to the neighborhood, and it is to be regretted that the State of Maryland and also of Virginia do not awake to the value of these sources of wealth, thus profusely scattered in the very positions where they can be made so highly beneficial. In the localities of the miocene and the upper tertiary beds, and the strata of drift, gravel, and sands, and the quaternary layers which skirt the borders of the ocean—the banks of the large embouchures or bays, as the Delaware and the Chesapeake, the Potomac and other rivers, where a sandy clay constitutes the chief surface soil, and where fertility is to be assured only by the utmost and continued efforts of labor and by manures, the latter being often unattainable or of high price—the marls described would prove very valuable, converting sandy and pine deserts into regions of agricultural wealth rivaling any market garden on alluvial clay. Where exposures are met with, the beds should be cleaned out, examined by some competent person, and the value chemically ascertained. Private enterprise will never take the initiative in this pro-

ceeding. An exploration, conducted under the auspices of the State governments, would return tenfold the amount expended, not merely in the value of the marl lands, but in the increased productions of the land enriched by them, in the altered cultivation which must necessarily ensue, and in bringing the shore counties of Maryland and Virginia into close connection with the food markets of Baltimore, Washington, Philadelphia, and New York. A survey, under a competent superintendent and staff of assistants, could accomplish the work in one season, at a cost of a few thousand dollars—a sum almost every year squandered in useless or harmful legislation.

The marls of Maryland and Virginia, as already stated, resemble those of Delaware; and, viewed in their geological relations, are superimposed on the sandy marl and the clayey greensand beds of New Jersey, which are the subdivisions of the cretaceous formation in that State. The lower divisions of the tertiary series contain the shell layers of calcareous sand, so abundant in Stafford County, Virginia, and elsewhere. The lower beds of the cretaceous series of New Jersey are met with in the following order, as given in the late survey by Professor G. H. Cook: top earth; micaceous clay; marl with clay, sand, and shells; lower marl bed; sand marl; laminated sand. Above these lie the beds of greensand proper, as alluded to, and above these again are the eocene beds which, except that of Marlborough, are the only deposits exposed in Maryland and Virginia. This difference of geological position is thus dwelt upon here, as there is some confusion on the subject; and there exists a general belief that the Virginia beds are of the true cretaceous series.

The fossils occasionally found in some of the specimens of marl forwarded are shells of *Pycnodonta (vesicularis?)* and *Terebratula plicata*, which fact perhaps places them in the lower group of beds. No traces of amber or vivianite, (phosphate of iron,) which have been met with in more or less abundance in New Jersey, have been forwarded, alone or in samples, to this department. Many of the marls forwarded from North Carolina, as well as from Virginia, appear to belong to the tertiary, either eocene or miocene marls in position, and neither pond marls nor greensand formations; the basis being quartz sand, with a sprinkling of ferruginous clay. The black clay and marls, which are occasionally acid, contain free sulphuric acid, with moderate amounts of organic matter, potash, phosphate, sulphate of lime, and carbonates of lime and magnesia. They may be used as top dressing from five to twenty tons per acre, either composted or alone. In the growth of potatoes these marls are of much value. The following are the results of the chemical analysis of some of the Potomac marls:

Marls from Prince George's County, Potomac shore, near Oxen Run, opposite Alexandria.

EXAMINED BY ELUTRIATION.	No. 1.	No. 2.	No. 3.
Clay			3.
Shells and carbonate of lime	10.50	23.	14.
Greensand grains	32.	28.	33.
Fine colorless angular quartz	57.50	49.	50.
	100.	100.	100.

Marls from Prince George's County, Potomac shore—Continued.

EXAMINED BY ANALYSIS.	No. 1	No. 2	No. 3.
Moisture	9.	9.	12.
Silica and insoluble silicates	[illegible]	[illegible]	[illegible]
Alumina and peroxide of iron	11.40	10.48	[illegible]
Phosphate of iron	.18	.15	.22
Carbonate of lime	[illegible]	[illegible]	[illegible]
Carbonate of magnesia	traces.	traces.	traces.
Soluble saline matter	.64	[illegible]	.31
Potash	.18	.16	[illegible]
Sulphuric acid	......	......	1.30
	100.	100.	100.

No. 1. Light-greenish color, and abounding in shells.
No. 2. Light-greenish color more shelly, and containing fine calcareous powder.
No. 3. Brownish color more shelly, and containing calcareous powder.

Greensand marl from Aquia Creek, Stafford County, Virginia, one and one-half mile above the landing—from A. T. C. Dodge's.

Moisture	4.00
Alumina and peroxide of iron	5.00
Carbonate of lime	42.40
Carbonate of magnesia	1.00
Saline matter soluble in water, containing alkaline sulphates and chlorides	0.50
Potash	0.10
Silica and insoluble silicates of lime and iron	46.80
	100.00

This marl contained three to four per cent. of glauconite.

Marl from Prince George's County, Maryland—from L. F. Bingham.

Dark green granules and fine sand	45.79
Shell marl, (lime, ferruginous clay, &c.)	54.21
	10.000

The shell marl contained—

Carbonate of lime	45.08
Carbonate of magnesia	1.13
Oxide of iron and alumina	2.38
Phosphoric acid	trace
Organic matters	3.80
Water and loss	1.82
	54.21

Marl from St. Mary's County, Maryland—from Colonel Wilson.

Insoluble silicates and fine sand	58.50
Alumina and peroxide of iron	9.20
Carbonate of lime	17.20
Magnesia	0.20
Soluble salts containing three-fourths of one per cent. of potash	3.00
Moisture and loss	11.90
	10.000

Marl from Pye's Landing, Charles County, Maryland.

Insoluble silicates and fine sand	64.60
Alumina and peroxide of iron, with traces of phosphoric acid	2.60
Carbonate of lime	23.00
Sulphate of lime	1.41
Soluble alkaline salts	0.55
Moisture and loss	7.84
	100.00

The foregoing, selected out of many analyses made in this laboratory, show the general chemical composition of these marls as they occur in these two States. Of many samples forwarded no certain information concerning their relative position as to the accompanying beds of sand could be obtained; so that, from an account of their stratification, it is not possible to state to which bed they belong. Indeed, it is questionable whether the true cretaceous beds have yet been anywhere exposed or utilized in Virginia. In making the analyses alluded to, the strictly chemical examination was not always adhered to, the test by washing often sufficed to give the information needed. In the case of marls, which are composed of mineral ingredients the specific gravity of which differ, the method of elutriation, or separation by water into layers, may often be adopted, by which a tolerably exact appreciation of the different proportions may be obtained; thus, carbonate of lime, quartz sand, clay, and glauconite being the four constituents, by placing a pulverized sample of marl in a tall cylindrical glass jar graduated to a uniform scale, filling the vessel up with water, and agitating the whole by a rapid rotary motion until thoroughly mixed, then allowing to settle, it will be found that these four constituents separate to some extent, and are deposited in layers at the bottom of the jar, in accordance with their different gravities. The glauconite, being the heavier, will settle at the bottom, then the quartz, above that the clay, and at the top the carbonate of lime in shell or fine powder. By a little care and preparation before hand this mode of examination may be made tolerably exact. Another method of elutriation consists in stirring the marl in water, pouring off the muddy water, and leaving the washed grains of marl with the sand and gravel. The clay is thus separated, and may be collected and dried after it has settled. The washed marl may be then dried, the gravel and sand picked out, and each dried and weighed. This plan has been used in the geological survey of New Jersey. Looking upon the glauconite as the chief source both of the potash and the phosphoric acid, whether existing as phosphate of iron in the more glauconitic marls, or in the calcareous and the pyritiferous marls, as phosphate of lime, the determination of the amount of glauconite by some ready and easy method becomes a matter of practical importance. There is no plan for this object which can be more readily adopted than this one of elutriation. In the dry specimen the eye may be deceived as to the amount of green grains; but when the whole has been made to deposit slowly, or has been washed off by moving water, the separation is tolerably perfect, and may be completed by picking out the green grains. From this approximate estimation of glauconite a calculation of both potash and phosphoric acid may be made. The greensand marls of North Carolina have the characters of those tertiary beds of Maryland and Virginia, already described, with perhaps larger admixture of worth-

less matters. They are very sandy, the silicious element of fine quartz sand constituting sometimes nine-tenths of the whole; and they contain much less potash, and more lime carbonate, than those of New Jersey. The exposures of greensand are not frequent, although these beds are classed as true cretaceous beds in that State. The heavy covering of detritus and sand, and the slight elevation of the section of country underlaid by these marls, have caused little denudation, so that it is only along the larger rivers that exposures occur, as is instanced at the Cape Fear River, the Neuse, and the Tar. The beds, also, from their slight elevation, rarely appear above the river bottoms, and cannot be followed to any extent downward. Professor Emmons, in his report of the geological survey of this State, says that in no place in North Carolina has he ever found the potash to equal what exists in New Jersey. A few analyses of the North Carolina marls, made by Professor Emmons, are here appended, to illustrate their chemical composition.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Silex and sand	37.00	70.43	91.00	913.0	79.00
Peroxide of iron and alumina	6.40	9.00	4.70	5.80	8.80
Carbonate of lime	33.40	11.40	1.00	0.19	2.75
Phosphate of peroxide of iron	1.60	....	....	....	....
Soluble silica	1.40	....	0.20	....	0.60
Magnesia	13.60	0.20	0.70	0.13	1.60
Potash	1.40	0.38	0.23	0.15	1.73
Soda	2.10	0.42	0.26	0.13	0.30
Sulphuric acid	....	....	....	0.30	0.20
Organic matters	1.60	4.80	....	....	2.00
Water	1.80	3.80	1.50	1.20	2.33
	100.30	100.43	99.39	99.20	99.32

No. 1. Lowest stratum at Black Rock, on Cape Fear River.
No. 2. Upper bed at Black Rock, on Cape Fear River.
No. 3. From Kingston, on the Neuse River.
No. 4. From Colonel Clark's, Tarborough.
No. 5. From banks of Tar River, three miles from Tarborough.

With the exception of Nos. 1 and 2, these beds are almost destitute of lime, yet they contain but little potash or soda. They yield on an average from nine to seventeen per cent. of fertilizing matters, and are no doubt valuable applications on the soils contiguous to the pits. Individual owners should always fertilize their lands with such marls. When silica exists to the amount shown in Nos. 3, 4, and 5, named above, transportation is out of the question. When silica is more than seventy per cent., unless very rich in potash and soda, it does not pay to transport marl beyond a few miles. The shell marls of the eocene formation, which contain from forty to seventy per cent. of lime carbonate, do not pay for transportation more than two to four miles, according to Professor Emmons; while the marl of Black Rock (No. 1) will be profitable at greater distances. The amount of potash in this marl is equal to thirty-one and a half pounds per ton. The professor views the phosphate of lime, which is always present in these marls, as one of their very valuable constituents. Sulphuric acid is always present, sometimes in the free state, but frequently as sulphate of lime, (gypsum,) which is the origin of the free acid; and thus the gypsum in every marl is probably to be traced to the pyrites which, by oxidation of its sulphur, forms sulphuric acid. The cretaceous beds occupy about one-tenth of the State of Mississippi, situated in its northeastern portion. Of this region the equivalents of the greensand beds are found only in the eastern parts of Tippah County, Pontotoc, and part of Chickasaw,

embracing a belt not more than ten miles wide. The glauconitic layer is found mixed with disintegrated shell, highly sandy, and a poor representative of the northern series as it appears in Monmouth County, New Jersey; there being but one bed from one foot to three feet thick, and not averaging more than five to seven parts of potash in every thousand of marl. The chemical constitution of this series in Mississippi is shown by the following analysis from the State Geological Report, made by Professor E. W. Hilgard, State geologist.

	No. 1.	No. 2.
Insoluble sand and clay	73.410	62.441
Potash	0.702	0.730
Soda	....	0.272
Lime	6.315	7.952
Magnesia	0.886	1.560
Brown oxide manganese	0.050	0.160
Peroxide of iron	7.055	11.849
Alumina	5.888	5.865
Phosphoric acid	0.046	0.266
Carbonic acid, water, and loss	5.640	9.905
	99.992	101.000

No. 1. Wilhite's marl, Tippah County. No. 2. Marl from O. Davis's well, Ripley County.

The glauconite in these marls does not exceed one to two per cent., and, sandy and poor as they are, they yet have been used with good effect; that of Ripley County has been laid on clay lands at the rate of four hundred to six hundred bushels to an acre. It is remarkable that the sand marls of the rotten limestone group of this State, which lies immediately below the glauconitic layers, contain fully as much potash, seven parts in a thousand, which perhaps is to be accounted for by the mineral origin of the sand, it being derived from the debris of a micaceous rock. Almost all the marls of Mississippi contain phosphoric acid, the average amount of which varies from two to three parts per thousand. This accounts, in a measure, for the value of even the sandy marls of the State.

ACTION AND VALUE OF GREENSAND MARLS.

The action of these marls depends on the influence of the predominating elements, which are lime carbonate, potash, oxide of iron, and phosphoric acid. The action of carbonate of lime in a marl is too well known to need elucidation in a report like this. Valuable as this form of lime is as a food of plants, and a necessary constituent supplying lime to their frame-work, its importance as an amendment of soil in a marl or manure is yet but secondary. Those substances which are constantly undergoing change of condition by oxidation are those which are the essential constituents of a manure; under this head the oxides of iron, and the salts of iron reducible to oxides, must occupy the first position. We cannot greatly err by estimating very highly the action of the protoxide and the peroxide of iron. This metal holds its oxygen with but a medium force, yielding it up to other bodies which have stronger affinities for it, and in turn taking oxygen from substances which hold it but loosely, and passing from the condition of protoxide to that of peroxide. Iron thus becomes a storehouse of oxygen for the soil and for the use of growing plants; and it is this moving oxygen which is continually entering into compounds and leaving them which contributes to build up the tissues and the juices of growing vegetation. Although not

entering to any notable extent into the actual composition of plants, yet iron is one of the most important elements of soils in aiding plants to grow. It shares this function with *organic matter*. They are both stimulants, increasing the nutrition by the supply of oxygen which they yield to other proximate principles of vegetation. The iron of a soil is generally reported in an analysis as existing in the state of peroxide; but, strictly speaking, no soil contains iron in state of peroxide alone. Some of it is in the form of protoxide, brought to this condition by organic matter, which has robbed the peroxide of some of its oxygen. In this double state it exists in greensand. The organic matter of a soil, by contact with oxide of iron becoming oxidized, is changed into vegetable acids which are soluble, and unite with the lime and magnesia to form soluble salts of those earths, which then enter the rootlets of the plant and aid in forming tissue in the sap. Perhaps the fertility of basaltic soils is as much due to their oxides of iron as to the lime which they contain.

This reaction of iron oxides and organic matter upon each other occurs only in the presence of moisture and sunlight, (heat;) and moisture itself, with heat, is at times a fertile cause of oxidation, and of the nutrition of plants. Away from the influence of these forces of nature the action of protoxide of iron is only injurious to vegetation. Under solar influence and contact of protoxide of iron, water itself is decomposed, its oxygen appropriated by the iron to peroxidize it, and the hydrogen liberated. The latter, coming into contact with the nitrogen of the air, forms ammonia, which is seized by carbonic and other organic acids, rendered soluble in water, and fit to enter the plant. Thus, iron is the medium between the water, the organic matter, and the atmosphere.

These remarks are made to illustrate the action of greensand marls upon vegetation as far as their iron element is concerned. In these marls it exists chiefly in the state of peroxide, which, upon mixture with vegetable matters, is reduced to protoxide by contact with the moist humus; then, being restored to the condition of peroxide by contact with moisture, the consequent liberation of hydrogen forms ammonia secondarily. Iron thus aids in forming soluble organic matter, as organic acids, and also ammonia, two important principles of fertility. We should, therefore, err if we estimated the value of a greensand by taking into account only its lime, its potash, or its phosphoric acid. We should consider the oxide of iron as a valuable constituent in promoting fertility.

The presence of potash in these marls gives them their distinctive character as fertilizers, and adds one of the most important elements necessary for plants. The large amount of potash found in glauconite renders it at once the cheapest source for agricultural use from which this mineral element can be supplied. The action of potash is twofold: first, upon the insoluble organic matter of a soil, bringing it into a soluble form; and, secondly, supplying to certain food plants the special alkaline food which they require. By the constant action of alkalies, (and of this class potash is the most efficient,) the insoluble organic matter, humus is converted into humic acid, and carbonic acid is also produced. Both of these acids ultimately unite with the potash and form carbonates of that base, which salts, when formed, enter the rootlets of the plants in a limited degree, remain for a short period in the vegetable organization, and are then ejected—perhaps not wholly. Under this influence the woody tissues of plants are formed. In the development of leaf and tuber potash seems essential. It is chiefly aggregated in the leaves of most plants, as it is in the muscular

juices of animals, forming not less than twenty and sometimes more than fifty per cent. of the leaf weight—the latter amount being found in the roots and tubers. The straw and chaff of cereals also contain it in variable proportion. Perhaps nowhere is the selecting power of plants for special mineral salts better shown than in the distribution of potassa. Dr. Anderson illustrates this by the case of the poppy, which contains only twelve per cent. of this alkali in its seed, while the leaves yield upward of thirty-seven per cent.

Sufficient has already been written concerning the value of phosphoric acid and phosphate of lime to render any statement unnecessary here. All cretaceous marls contain phosphoric acid, whether combined with iron or lime; and phosphate of lime is, perhaps, more valuable than lime as a fertilizing agent. The form in which potassa exists in these marls is as a silicate, and it is slowly decomposed under mere atmospheric exposure. On soils which contain lime or much humus, the decomposition proceeds at a more rapid rate, owing to the evolution of carbonic acid; and in this way this alkali is slowly evolved for the benefit of vegetation. The long-continued beneficial action of greensand on grounds may in part be explained by the gradual nature of this decomposition.

In New Jersey, along the line of the Raritan and Delaware Bay railroad, where it is sold at eight cents a bushel, it is applied at the rate of one hundred bushels per acre; and on these light soils produces a better effect than the usual dressing with stable manure, especially for small fruits and market-garden vegetables. In Delaware, from three hundred to five hundred bushels have been applied per acre for wheat, oats, and other cereals, with sometimes a fourfold return. A decided benefit, but not to the same extent, is experienced on grass. Generally, it may be said that land has increased by its use from fifty to one hundred per cent. in value. The value of marling south of New Jersey is the combined value of the carbonate and the phosphate of lime, and of the potassa. When the marls are more calcareous, they become amendments to the soil rather than fertilizers to the crops, and much larger dressings are therefore necessary; while, at the same time, more discrimination is required as to the land which will be mainly benefited by the application. The lime being in predominant quantity in the greensand marls south of Delaware, the action is chiefly upon the organic matter of the soil, combining with it and rendering it more soluble. Hence, to poor and light soils it would be unnecessary to apply heavy dressings; for these, fifty to eighty bushels per acre might be sufficient. On stiff, clayey soils, the texture of which may be lightened advantageously, from one hundred to three hundred bushels per acre may be applied. In these clay soils there is generally more insoluble organic matter to be acted upon, and in such cases so large a quantity as five hundred bushels per acre acts beneficially. In general terms, then, it may be stated that the calcareous greensand marls act more effectively in proportion as there is organic matter present, and in proportion as the clay is a heavy one.

It is not easy to determine exactly the value of a compound manure like this. The question is a commercial one, and would not properly be discussed here were not the value in a great degree dependent upon the chemical analysis. Were the fertilizer composed of but one ingredient, it would be easy to determine its value by ascertaining the market price of the pure and commercial article, and then determining how much of such ingredient existed in the manure. Thus, if phosphoric acid in a soluble state is worth commercially fifteen cents per pound, and the

fertilizer contains one hundred pounds in a ton. it is evidently worth fifteen dollars per ton when delivered.

When a manure has a complex constitution, the real value becomes a difficult problem to state exactly, for the agricultural and the commercial value do not always agree. The former is fixed and invariable, dependent on the necessities of the plant and the soil: the latter is liable to fluctuation from the unsteadiness of the supply and demand. The following estimate is approximately correct. The value of phosphoric acid in the soluble form may be set down at fifteen or sixteen cents per pound: phosphoric acid in insoluble form, six cents per pound: potash in the soluble form, seven cents per pound: potash in the insoluble form, two cents per pound: sulphuric acid, one cent per pound; carbonate of lime, half a cent per pound. If we calculate the value of one of the inferior greensand marls of Maryland, as No. 3, from Prince George's County, we obtain:

320 pounds carbonate of lime, at $\frac{1}{2}$ cent	$1 60
6 pounds soda salts, at 1 cent	06
2 pounds phosphoric acid, insoluble, at 6 cents	12
$1\frac{6}{10}$ pounds potash, soluble, at 7 cents	11
26 pounds sulphuric acid, at 1 cent	26
	2 15

This estimate is somewhat below the real value of the compound, since it estimates each article singly, and takes no account of the effect of the different ingredients of the mass upon one another in rendering them more readily soluble, more stimulating to and more fit for appropriation by the plant. The general method of calculating values, however, may be of interest to many who desire to know how estimates should be made.

What we have just stated—that the value of a compound manure is greater than the sum of the values of its separate constituents—needs some remark: otherwise, and with justice, the farmer might say: "Why should I dig and haul so bulky a material as this marl, containing as it does not more than five positively useful ingredients, amounting to ten per cent. of the whole weight, when I can buy these several salts from the wholesale druggist, and then dilute them afterward on the ground? Would it not be actually cheaper to buy the chemicals and make my own compost, rather than to take the bulky form in which nature supplies them?" The answer to these questions lies in the following considerations: Admitting that both the artificial salts and the natural marl have an equal manurial value and action, still the farmer should remember that he is often richer in cattle and human labor than in ready money: that in idle seasons he can haul and spread his native marl, (if it is a month or two sooner than it is actually needed, it suffers but little from exposure,) while, as regards the purchased salts, they must be bought only when required, as they waste and lose by exposure to the air and moisture. They can be applied only at a certain period for the benefit of the growing crop, because they readily dissolve in water. They act readily on the crop, and are effective during the particular season in which they are applied: but their action, while immediate, is also transitory. It is felt less the next year, very much less the following year, and subsequently cannot be recognized except, perhaps, by a diminished productiveness of soil. On the other hand, in the case of natural marls, the elements are but sparingly soluble, and consequently

given out only by little at a time, as the plant needs and has ability to appropriate. Hence their action, while slow, is of a permanent character, and can be ascertained after many years. In New Jersey one of the first applications of greensand, over sixty years ago, so enriched the field that it was recognizable as improved thirty years after the application; and in North Carolina the alluvial lands which have been manured with these marls have retained their superiority over unmarled lands for over fifty years without a second dressing. When this increased and permanent fertility has been experienced, it is not wonderful that the natural should be preferred to the artificial compounds, or that over one million bushels of greensand marl should have been dug and sold in New Jersey in 1868.

NATIVE PHOSPHATIC MANURES.

During the year, samples of mineral from the newly discovered phosphatic beds of Charleston, South Carolina, were forwarded for analysis. These beds have received great attention lately, owing to their containing a large amount of phosphate of lime; and much has been communicated to the public concerning them, by Drs. Pratt and Holmes, and Professor C. U. Shepard, jr., M. D., of Charleston. Their geological position as strata had long been known and described, but it has been only within the past few years that their extreme richness in phosphate of lime at once classed them as one of the most valuable mineral beds of South Carolina.

The strata containing phosphate of lime range in position, in South Carolina, from the early miocene to the middle bed of the post pliocene formation. It was during the early tertiary period that the greater portion of the shore land of the Carolinas, and south by Mobile River to the western limits of Louisiana, was formed by deposition and subsequent extensive, slow, and uniform elevation. The Claiborne marls and shell sands of Alabama are the lowest beds of this series, with the more solid buhr-stone and the white limestone marls of the Santee River. Above these, in the same group, occur the gray marls of the Ashley and the Cooper Rivers, abounding in rhizopods. These are miocene beds, and upon them lie, unconformably, the post pliocene sands and marls, one of which embraces the material now so much sought after for its agricultural value.

All of these strata contain phosphate of lime in marked quantity. The marl beds of Charleston are of wide extent, embracing, according to Dr. Tuomey, an area of seventy-five miles by sixty, from the Santee River on the east to the Ashepoo on the west, and lying between the Atlantic Ocean on the south and east and the buhr-stone formation of the eocene beds on the north. They are beds of white limestone marl and greensand, dipping gently to the south, and underlying the newer beds of marl of the Ashley and Cooper Rivers, the former of which constitutes the uppermost stratum of the eocene. The thickness of the Santee beds is between six hundred and seven hundred feet, and has been recognized as underlying the whole neighborhood of Charleston. Dr. Smith and Professor Shepard found what was deemed an unusual amount of phosphate of lime, ranging from two to nine per cent. of that mineral. This amount, while constituting a rich soil, did not justify its use or transportation as a marl, the value of which is to be estimated by the amount of lime phosphate it contains. The quantity of carbonate of lime is very great, varying from fifty to eighty per cent., and the value had hitherto been estimated according to the amount of this ingredient.

The fish-beds of the Ashley River yielded to Professor Shepard the following constituents:

	No. 1.	No. 2.	No. 3.	No. 4.
Silica	28.60	29.08	10.20	16.00
Carbonate of lime and magnesia	58.60	53.98	68.60	82.80
Phosphate of lime and peroxide of iron	7.60	7.00	8.60	2.80
Alumina	.80	.80	1.00	1.00
Water	4.00	4.00	4.00	2.00
	99.60	94.86	92.40	104.60

No. 1, from Mr. J. P. Clements, west of Ashley River; No. 2, from Rev. Dr. Hankels, bank of Ashley River; No. 3, from Drayton Hall, bank of Ashley River; No. 4, from Wilmington, North Carolina.

The first three analyses give the average composition of this stratum about Charleston. No. 4 gives the constitution further north, showing that it becomes more purely calcareous as it passes northward, until it finally thins out and disappears before it reaches New Jersey.

Above this bed of calcareous marl is a layer of blue sand, in which are found hard masses of grayish or bluish-white rock, which break readily into fragments, and have been called nodules. These constitute the material now so much sought after, and are described by Dr. Tuomey, in his survey of South Carolina, as scattered over the surface, so as, in some places, to offer obstruction to the cultivation of the land, and therefore have been gathered in heaps from the land of the plantations near the Ashley River, in order to render cultivation possible.

Professor Shepard, jr., in an article in the Massachusetts Ploughman on these phosphatic beds, describes their appearances as follows: "The chief beds were discovered on the Ashley River, extending from about seven miles above Charleston up the river for ten to fifteen miles. The land is not level but rolls in low bluffs, generally twenty to forty feet high, at right angles to the course of the river. Between these bluffs there are swamp lands, most of which have canals through them, and were once thoroughly drained for the culture of cotton. In these low lands the rich top soil is about four to six inches in depth; there follows a light sandy stratum sometimes eighteen inches thick, generally less; and, underneath, the stratum of nodular phosphates, packed close together with hardly any soil between them." Professor Holmes had, as far back as 1844, described the occurrence of a conglomerate layer, consisting of nodules imbedded in a blue sandy clay, about twelve inches thick, overlying the marl beds the composition of which has just been given. They require the use of the pick to remove them, and are locally called marl-stones. The remains of marine and of terrestrial animals are found in this bed, and casts of fossils common to the marl bed below, (Holmes.) It is remarkable that these nodules and fossil remains were looked upon as pseudomorphs in which the carbonate of lime has disappeared, to be replaced by silica; the phosphate of lime having escaped recognition until its real composition was declared by Dr. N. A. Pratt, from examination of several of the nodules in August, 1867, which revealed the fact of a large percentage of phosphate of lime, instead of silica, in them. According to a statement made in a pamphlet entitled "Ashley River Phosphates," and printed in Philadelphia at the close of 1868, Dr. P. found in these nodules as much as 34, 55, and 66 per cent. respectively; in fact they were true bone phosphates, in some samples of which the amount of phosphate exceeds that found in bones of living mammals. This discovery led to the formation of a company, residing in Philadelphia, to raise and export the material. The works

of the company engaged in bringing this fertilizer to market are extensive, and located on the Ashley River, about ten miles above Charleston. Their wharf is on a bluff, and is accessible to any vessel which can cross the bar below the city. The land approach is by the Dorchester road. At the close of the year 1868 the export trade in this substance was extensive, the Charleston papers announcing daily the loading of eight to ten vessels on the Ashley River. These vessels are chartered either for Baltimore or more eastern markets, where the crude material is manipulated, and mixed with ammonia salts, to form phosphatic guano, or else merely crushed to form the ground of phosphate of lime. The domestic manipulation of this pulverized phosphate is practiced, to a considerable extent, by the farmers of northern Maryland and the border counties of Pennsylvania. Some mix the phosphate with farm manure, while others buy crude ammonia from the druggist, and mix them together.

Dr. Pratt describes this phosphatic bed as "varying from four to eighteen inches in thickness, sometimes, though rarely, increasing to two or three feet, and in some places thinning out to a few scattering nodules on or near the surface. It consists essentially of indurated, irregularly-rounded nodules, buried in an adhesive and tenacious blue clay and sand; sometimes, however, it exists in continuous beds, or large lumps, or conglomerates of soft chalky consistency, as if it were originally a soft pasty mass of phosphatic mud that has since become semi-consolidated. Associated with these is a most wonderful assortment of animal remains, among which bones of marine animals are so abundant as to have induced Professor L. Agassiz, twenty years ago, to call it the 'fish bed' of the Charleston Basin."

The nodules he describes as rough, irregular in form, water-worn, and rounded, perforated by boring mollusks, though generally only the casts of them remain; under the microscope they exhibit the unmistakable characters of bone, are easily soluble even in dilute acids, free from phosphate of iron and alumina, with a very low percentage of carbonate of lime. From one specimen of a mastodon bone Dr. Pratt states that he obtained 85.62 per cent. of pure bone phosphate, and the nodules contain on an average from 57 to 67 per cent. of bone phosphate.

Professor C. U. Shepard, jr., of Charleston, who, as far back as 1860, appreciated the value of this bed, and urged upon the Agricultural Society of South Carolina the importance of utilizing it, describes, in the paper above referred to, the size of the nodules as being from that of a boy's fist up to a man's head, some of a light color, and easily crushed in the fingers, and yielding the following results. A soft nodular phosphate between the Cooper and the Ashley River:

Moisture driven off at 212° F	3.05
Water and organic matter	6.03
Sand and sesquioxide of iron	12.83
Carbonate of lime	8.06
Sulphate of lime	2.20
Phosphate of lime and iron	69.00
	101.17

The phosphate of iron rarely exceeded 5 per cent. and was much less in the light-colored phosphates. Dr. Shepard states that when freshly dug and fractured, the fresh surfaces give off a very strong organic odor, so characteristic as to be made the means of detecting the phos-

phates throughout the region of the deposit. This odor is also found in the dry specimens, whether hard or soft; the amount of nitrogenous matter is small, not exceeding 0.5 per cent. of ammonia. Under this bed a phosphatic marl occurs, reaching to the depth of four hundred feet, as ascertained by boring, and containing, according to Professor Shepard, 14 per cent. of phosphate of lime. The nodules lie so close that an acre of the deposit has yielded thirteen hundred tons of nodules, even after rejecting small samples. These, when clean and dry, have brought occasionally as high as fifteen dollars per ton. Much of the land, between the rivers and overlying the stratum, is covered with dense forest. The phosphate is obtained by digging a trench one or two feet wide, cutting through the phosphatic stratum, and cleaning out the ditch; the laborer then stands in the trench, and with a shovel uncovers the surface clay and sand, laying bare the layer of nodules. Then, with a few blows of the pick, the latter are loosened, and the nodules picked out with the hand and thrown into heaps, which are then drawn on the tramway, in carts, to the washers, or long troughs with horizontal shafts inside, furnished with paddles, and worked with a strong stream of water from a force pump. When the washing is completed, the nodules, free from clay and sand, are delivered out through a vent, and sold on the wharf.

The following analyses of these phosphates, samples of which were forwarded by L. Sangston, esq., president of the Maryland Fertilizing and Manufacturing Company of Baltimore, have been made in this Laboratory, No. 1 representing the nodules, and No. 2 the fossil bone:

	No. 1.	No. 2.
Moisture and organic matter	2.50	1.80
Insoluble silicates and sand	19.40	9.20
Phosphate of iron and alumina	12.20	6.00
Phosphate of lime	56.00	64.10
Carbonate of lime	8.00	17.40
Magnesia	Trace.	Trace.
Alkaline salts, chlorides, and sulphates	1.80	1.40
	99.90	99.90

The composition of No. 1 shows what alteration it has undergone by the clayey admixture which has crept in, and by the loss of almost all its organic matter. We place here for comparison the composition of recent bone of the ox as given by Fremy, (Watts's Dictionary of Chemistry,) when deprived of its organic matter, which generally is 33 per cent.:

Per cent. of ash	3.17
Phosphate of lime	62.50
Phosphate of magnesia	2.70
Carbonate of lime	7.90

This includes the ash of the organic matter, or ostein, burned off.

It may be observed that, in the fossil bone, the magnesia salt has disappeared, and is replaced by some alkaline salt, introduced by percolation; that the organic matter is almost wholly replaced by the fine clay deposited in its structure; and that the whole mass has been cemented by a solution of carbonate of lime, contained in waters running through the beds under pressure. As regards the amount of bone phosphate, these fossils are as rich as the recent bone, and much richer than Swan Island, Navassa, or Bolivian guano. The nodular bed No. 1

resembles, more nearly than No. 2, the coprolites of England, as analyzed by Herepath, but gives much less lime carbonate. An analysis of fossil bone, from the greensand beds of Virginia, is here appended:

Moisture and organic matter	1.50
Insoluble silicates and sand	17.40
Phosphate of iron and alumina	10.94
Phosphate of lime	55.20
Carbonate of lime	12.60
Magnesia	trace
Soluble salts, chiefly chlorides	2.30
	99.94

The bones were found in the Potomac River when raking oysters below Aquia Creek. By soaking in brackish water, and by deposit, they have undergone some alteration, even from those found in the greensand beds.

It is still interesting to observe how large an amount of lime phosphate is preserved after so long-continued solvent action of the weak saline water of the Potomac River at that point.

THOMAS ANTISELL, *M. D.*

Hon. HORACE CAPRON, *Commissioner.*

THE FOOD AND HABITS OF BEETLES.

The following suggestions are submitted, partly from personal observation, and partly from the best authentic sources, both American and foreign, for the use of young entomologists, or persons who wish to study and identify the various beetles injurious or beneficial to vegetable and to animal substances.

The first part will contain the latest scientific name, as also the common or vulgar appellation by which the insect is generally known, wherever it is possible to give it, with reference to some of the various authors who have described the insect, and a very brief history of its habits in the larva, pupa, or perfect state, together with the various vegetable or animal substances upon which it is found or feeds. Each insect, specially named, will be distinguished by a number in brackets, so as to be readily referred to by persons seeking information.

The second part will contain an alphabetical list of the plants and other substances upon which certain species of beetles feed, with the number in brackets before alluded to attached to it, as referring to the first part where the insects themselves are mentioned. The American works referred to in this sketch are those of Dr. Leconte, of Say, Harris, Fitch, the "American Entomologist," &c. The descriptions of the habits of the various families are taken chiefly from Dr. Leconte, or Westwood, an English entomologist, who, in his valuable work on the "Classification of Insects," gives the most lucid and brief descriptions, which will apply to the insects of the United States as well as to those of England, and in many cases throw much light upon the food and habits of many species in this country which have hitherto been unknown. The German work of Leunis also gives some very interesting details about the food and habits of several European insects, which also will be quoted. It is much to be regretted that many of our young entomologists merely collect, classify, and arrange insects in their cabinets for exhibition, without ever troubling themselves to ascertain anything about their previous existence as larva or pupa, or the plants upon which they feed when in the larva state, or the various transformations they undergo before they appear as perfect beetles. Were this subject made a more especial study, there is no doubt that farmers would learn much, and be better prepared to suggest methods of destroying them, than is the case at present.

PART I.

The first family of coleoptera (beetles), *Cicindelidæ*, contains many species. These insects are generally of medium size, of swift motions, and frequently of bright metallic green, bronze, or brown colors, having their wing cases ornamented with cream-colored spots or stripes, from which, and their great voracity, they have derived the common name of tiger beetles. The larvæ are fleshy, curved grubs, of a yellowish white color, with large and powerful jaws, and hooks or spines on their backs. They burrow cylindrical holes in the ground, in which they lie in wait for any passing insect. They lie at the mouth of this burrow, having their head and thorax closing the opening, so as to be ready to seize any other in-

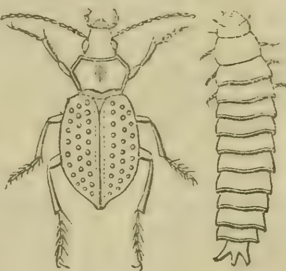
sect, which, when caught, is immediately dragged to the bottom of their burrow, and devoured at leisure. The pupa is also formed in the same hole, and the perfect tiger beetle may be seen, any fine day in summer or autumn, flying on hot, sandy roads in the sunshine, but generally alighting again at a short distance, with its head turned toward the intruder, so as to be able to make another flight if necessary. As these tiger beetles, in both the larva and the perfect state, destroy all other insects they can overcome, they may be considered beneficial, and will be classed under the head of "Predaceous" in the list of vegetable or animal substances destroyed by beetles. *Cicindela vulgaris* (1.) (Say, 2, pp. 422 and 522) is a very common species, and is of a bronze color, with cream-colored marks on the wing cases.

1.

The second family, *Carabidæ*, or ground beetles, vary very much in size, form, and color; their bodies are of a firm consistence, whereby they are enabled to creep under stones, bark, &c. Most of the species are eminently insectivorous, prowling about on the surface of the ground, under stones, or beneath the bark of trees or moss, in search of their prey, which consists of other insects. Some of the European species, however, are said to attack grain, and the larva of our native *Omophron labiatum*, (2) (Say, 2, p. 495), a small beetle of a black color, margined or bordered with a brownish yellow, is said to be very destructive to young maize in the southern States.

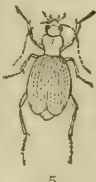
2.

One of our finest beetles of this family is *Calosoma calidum*, (3) Fab. (Say, 2, pp. 491 and 527). This insect is very common in Maryland and Virginia, and the larva was taken in the act of devouring caterpillars of the common army worm *(Leucania extranea, Guen)*, in an oat field, near Washington. Great numbers of the larvæ of the beetle were observed running about in the midst of the army worms, seizing and destroying all that crossed their path; some of them were indeed so voracious as to become bloated with food, and almost unable to move. When this was the case, the full-fed and inactive gluttons almost invariably became the prey of their more meager and nimble brethren. The perfect beetle is of a dark coppery color, beautifully dotted with several rows of metallic golden spots on the wing cases. *Calosoma scrutator* (4) Fab. (Say, 2, p. 491) is much larger in size, and of a most beautiful metallic golden-green color; in the perfect state it also feeds upon caterpillars and insects, even ascending trees to obtain its favorite food.



3.

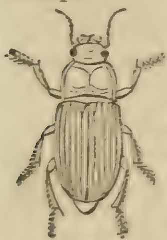
One of the family, *Brachinus fumans*, (5) (Say, 2, p. 439), is rather common under stones, and is mentioned here as having the singular habit, when either alarmed or irritated, of discharging from the posterior extremity of its body a caustic fluid; this discharge is remarkable for an audible detonation with its accompanying cloud of smoke as in the discharge of a gun; hence its common name of Bombardier beetle. Westwood states that the vapor, which is of a very pungent odor, is also emitted when chased by other insects, in order to enable it to escape from its enemies. The wing-cases of this beetle are of a dark color, whilst the head, thorax, and legs are of a yellow brown.



5.


6.

The *Lebiæ* constitute a sub-group, and are small, active beetles, some of them very beautifully marked. Many of this species are found on flowers. Numbers of the *Lebia grandis*, (6) a small beetle with wing covers and also thorax blackish, legs and head of a yellowish or ochre color, were taken feeding on the larvæ of the ten-lined spearman *(Doryphora 10-lineata)*, so injurious to the potato in the western States, in the month of July. Some of the tribe *Pterostichini* are stated, by European authors, to injure grain. *Calathus latus*, (7) (Westwood, 1, p 63), a European insect, is said to injure young wheat. The larva of *Zabrus gibbus*, (8) also European, is said by Leunis to feed on the roots and shoots of grain, while the perfect beetle itself consumes the grain or seed of barley, wheat, and rye in Germany. Westwood, 1, p. 61, also mentions a similar fact; it would therefore be well for some of our entomologists to determine whether we have not some allied species in this country, injuring our grain crops. Some of the species of *Amara* (9) are also said to destroy grain in Europe.


10.

Harpalus (Pangus) Caliginosus (10) (Say, 2, p. 454) is a medium sized beetle, of a brownish black color, which diffuses a very pungent odor, like that of vinegar, when disturbed: it has been taken in great numbers in Maryland, under wheat stacks, and is commonly supposed by the farmers to feed upon the grain of wheat; it is probable, however, that these insects have collected together in such situations for shelter, or to feed upon other insects usually found in such situations. It must, however, be confessed that this beetle has been taken under very suspicious circumstances in an open field on timothy grass stalks, apparently feeding on the seeds, when no other insect was visible to the naked eye, which might have been selected as its food.

Of the third family, *Amphizoidæ*, Dr. Leconte states that nothing is known about their habits.

The fourth family, *Dytiscidæ*, have the antennæ long and slender; their form is oval, elliptic, or rounded; and their hind legs are formed for swimming. These insects inhabit stagnant water, and are very voracious, feeding not only upon other aquatic insects, but also devouring fish-spawn or very small fish. Some of them occasionally fly by night from pond to pond, and are said to be attracted by a light.


11.

One of the largest species, (11) *Dytiscus hibridus*, (Lec.), was captured on the flat roof of a building in Maryland, at least four stories in height, where it had doubtless fallen during its nocturnal flight, and was unable to rise again. During the winter season the *Dytiscidæ* remain in the water, or bury themselves in the mud, where some of them remain in a torpid state, while others retain their vitality and activity even under the ice.

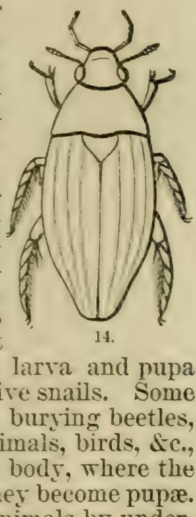
The fifth family, *Gyrinidæ*, comprises those oval water-beetles usually known by the name of "whirligigs" or apple-bugs: the former local name being derived from their habit of swimming in large numbers in circles, or labyrinthine curves, on the surface of the water; and the latter name from the peculiar apple or calycanthus-like odor which they emit when taken in the hand. The European species deposits her small, cylindrical eggs, which are placed end to end in parallel rows, upon the leaves of aquatic plants; the larvæ are said to hatch out in

about eight days, and to bear some resemblance to a young centipede. When they have attained their full size, they creep out of the water, up the stems of rushes or other aquatic plants, where they inclose themselves in oval cocoons, composed of a substance spun out of their own bodies. (Westwood, 1, p. 109). The perfect insect, if closely examined, presents the curious appearance of possessing four eyes, the organs of sight being divided by the side of the head. These insects are predaceous, and feed upon insects on the surface of the water. One of our most common species, *Dineutes (Gyrinus) Americanus*, (12) (Say, 2, p. 519), may be seen at all times, excepting in winter, circling around on the still pools of water, feeding on living or dead insects which float upon the surface.

12.

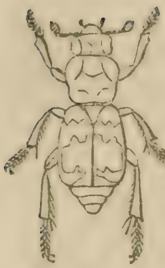
The perfect beetles of the sixth family, *Hydrophilidæ*, (13) live upon decomposing vegetable matter, although their larvæ are predaceous and quite voracious. The majority of them are aquatic, and are distinguished from other water-beetles by their club-formed antennæ; their bodies are usually of an oval form, and the hinder legs are ciliated or fringed with bristles, and formed for swimming, or rather for paddling, in the majority. These insects do not swim with the agility of the *Dytiscidæ*, already mentioned; they generally keep in the water by day, but during the evening sometimes come abroad and take wing. The European species, *Hydrophilus piceus*, (13) feeds chiefly upon aquatic plants, although they also devour with avidity dead larvæ and aquatic molluscæ. The female spins a gummy envelope for her eggs, which amount to about fifty or sixty in number, and are disposed symmetrically in an upright position in their receptacle, which has somewhat the appearance of a small turnip, being nearly an inch broad, and which is attached to some plant until the larvæ are hatched, when it floats upon the surface of the water. The larvæ escape at the lower part of the cocoon, which is merely closed by a few threads. As larvæ they undergo three moultings, and feed upon aquatic mollusks and insects inhabiting the water.

Hydrophilus triangularis (14) (Say, 2, p. 128) is a rather common species, and is found in ponds and ditches; the insect is of a shining black color. The fifth tribe, *Sphæridiidæ*, (15) are terrestrial in their habits, of small size, and feed upon putrescent vegetable matter which has passed through the bodies of herbivorous animals, (excrement).



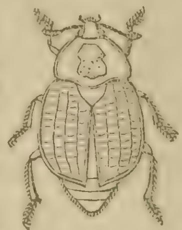
14.

The seventh family, *Silphidæ*, (16) feed on carrion, dead fish, snails, &c., &c., and are in some degree beneficial, inasmuch as they remove from the surface of the earth animal matter in a state of putridity, which would otherwise taint the air and become injurious to health. They are constantly found in carrion and the carcasses of animals. Some of the European species frequent trees, where they probably devour caterpillars. Both larva and pupa of *Silpha lævigata* (16) of Europe feed voraciously on live snails. Some of the larger species are commonly called sexton or burying beetles, from their habit of burying the carcasses of small animals, birds, &c., for the purpose of depositing their eggs in the buried body, where the larvæ, when hatched, find a sufficiency of food until they become pupæ. These insects effect their purpose of burying small animals by undermining the carcass, until it gradually descends into the ground, and then covering it with earth. One of our best known species is the (17) *Necrophorus marginatus*, (Fab.), which may be found at any time during



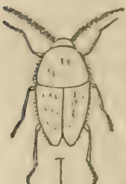
17.

the summer or autumn, in carrion. The insect is of a black color, barred with chestnut or reddish brown. *Necrophorus Americanus* (18) (Lec.) is a much larger species, also feeding on carrion, but is especially found in dead snakes. The *Necrophori* are usually large, stout beetles, of a black color, barred with light brown on the wing cases. They exhale a very disagreeable carrion-like odor, and are frequently infested with a species of *Gamasus*, or mite.



11.

Necrophila peltata (19) (Lec.) *Americana*, Melsheimer's catalogue, is a large, flattened beetle, with rugose, black wing cases, and thorax of a yellowish brown color, having a black mark in the middle; this insect feeds also on carrion. (20) *Adelops hirtus*, (Lec.), a very small brown beetle without eyes, belongs also to this family, and is merely incidentally mentioned as being found on bones, accidentally left in the mammoth cave, in Kentucky. The eighth family, *Scydmaenidæ*, (21) consists of very small insects, some of which are taken in ants' nests, but contain no species of interest to the farmer. This may also be said of the ninth family, *Pselaphidæ*, (22) which consists of very small insects, many of which fly during the twilight; their habits are various, some being found in ants' nests, while others occur under bark and stones. Leunis states that the European species, *Claviger foveolatus*, (23) is found in the nests of the yellow ant, which treat them with great care, occasionally taking them up in its jaws, when they would escape. Westwood considers it not improbable that the *Claviger* secretes a fluid analogous to that of the *Aphides*, or plant lice, from the setæ or bristles at the extremity of the abdomen. Müller also adds the curious fact that the ants in return feed the *Clavigers* from their own mouth. Many specimens of (42) *Bryaxis* were beaten off of swamp grass, in May, near a pond, by Mr. J. W. Wilson, of New York.



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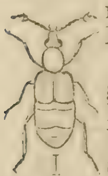
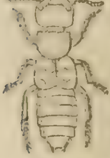


24.

The tenth family, *Staphylinidæ*, or rove beetles, contains a great number of species, almost all of them, however, more or less distinguished by their long, narrow, depressed form, and by their very short elytra, or wing cases, which cover only a small portion of their abdomen, thus leaving many of the segments visible.

Many of the larger species emit a very unpleasant odor when handled. They run and fly with equal agility, the wings, when unemployed in flight, being closely packed under the short wing covers. These insects are very voracious, and prey upon decaying animal and also vegetable substances, especially fungi. Several of the smaller species are very numerous on flowers, or under bark and moss. Westwood (1, p. 167) states that a small larva, (25) probably of this species, in Europe is said to injure wheat by eating the young plant about an inch below the surface, and devouring the central part, thus occasioning much damage. The eggs of the *Staphylinidæ* are of large size, and the larvæ bear considerable resemblance to the perfect insect in structure and habits. A very common native species, *Creophilus villosus* (26) (Lec.), was taken in great numbers, in October, from the body of a dead horse. This family, however, not being particularly injurious to the farmer, will be passed over.



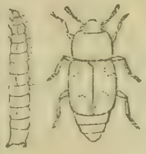
26.

The eleventh family, *Histeridæ*, (27) consists of insects of small size, square or oblong quadrate form, and of a shining black color. These insects possess the power of contracting their limbs and counterfeiting death; hence their common name of mimic beetles. The word "hister" is evidently derived from the Latin *Histrio*, a stage mimic. They feed upon both decaying vegetable and animal substances, and are found in abundance, in spring, upon the excrements of horses and cows. Other species, with flattened bodies, reside under the bark of trees, and some of the minute species are stated by Westwood to reside in the nests of ants. One of the sub-family, *Murmidiidæ*, (28) is stated by European writers to live in old rice.

Family twelfth, *Scaphidiidæ*, thirteenth, *Trichopterygidæ*, and fourteenth, *Phalacridæ*, are passed over, as being of no importance to the agriculturist.

The fifteenth family, *Nitidulidæ*, (29) are usually small beetles of an oval, depressed, or slightly convex form; sometimes, however, they are almost globular or elongate; they live on decomposing substances, both animal and vegetable. The second tribe of this family, *Carpophilini*, are usually flattened in form, and have the last two or three dorsal segments of the abdomen uncovered by the somewhat short wing cases, resembling in this respect the *Staphylinidæ*. *Colastus semitectus*, (30) a small brown beetle, is found abundantly in the flowers, or decaying bolls of the cotton, and the decayed ears of maize in the field, where they probably feed upon minute fungi. *Carpophilus hemipterus*, (31) a very small brownish-black beetle having four light spots on its short wing covers, is also found in similar situations. Tribe 3, *Nitidulini*, (32) consists mostly of small insects, with bodies oval sub-depressed, thorax margined, and their bodies covered by the wing cases; some of them live on flowers, under bark, in fungi, or on dried animal matter. The larvæ of one of the species, *Stelidota geminata*, (33) (Lec.), is stated by Dr. Walsh (1st Rep. Illin., 1868, p. 18), to feed upon decaying vegetable and also animal substances, and to breed in the holes made in grapes by *Cæliodes inæqualis*, a species of curculio.


30.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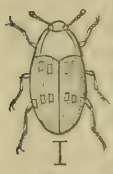

33.

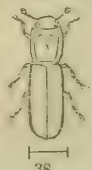
Ips quadrisignatus (34) (Say, 2, p. 644), a small black beetle with four yellow spots or marks on the wing covers, is stated in the Practical Entomologist, volume 2, page 56, to burrow into sweet corn; most of the other species are found under the bark of trees.


34.

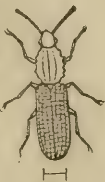
The sixteenth family, *Monotomidæ*, contains no insects at present known to be of any interest to the farmer.

The seventeenth family, *Trogositidæ*, consists of insects having the body more or less depressed, with short club-shaped antennæ; some of the species live under bark, while others injure grain. The larva of *Trogosita* (*caraboides* Fab.) (35) *Mauritanica* (Oliv.), a beetle of a brown color, is termed by the French *Cadelle*, and is very destructive to grain in granaries; it also destroys bread, and is found under the bark of trees. *Trogosita dubia*, (36) (Lec.), a very nearly allied beetle, was found in beech nuts; it also destroys wheat, maize, and other grains, in Maryland.

The eighteenth family, *Colydiidæ*, (37) consists of small insects, usually of an elongate or cylindrical form, living under the bark of trees, in fungi, or in the earth. *Aulonium (Colydium) paralellipipedum* (38) (Say, 2, p. 324) was found in great numbers on pine trees, apparently eating passages under the bark.


38.

The nineteenth family, *Rhyssodidæ*, is of no general interest to the agriculturist, and will, therefore, be passed over.



39.

The twentieth family, *Cucujidæ*, consists of small insects, almost always of a depressed, and usually of an elongate, form. *Sylvanus Surinamensis*, (39) a very minute beetle of a chestnut-brown color, and having several teeth or spines on the outer edges of the thorax, is found in wheat and maize; and several were taken out of passages or tunnels eaten in dried leaf tobacco. These insects may also be found dead in sugar, or floating in tea and coffee. *Sylvanus bidentatus*, (40) so-called from the two projecting teeth or spines on the front part of the outer edge of the thorax, is rather larger than the *S. Surinamensis*, and is also of a chestnut-brown color. Its larvæ are found under chestnut bark, where they probably feed upon the substance. *Sylvanus quadricollis* (41) resembles the others in general appearance, but has a quadrate or square thorax. The egg is deposited in maize, near the germ; the larva feeds upon the substance of the grain; it also has been found in rotted cotton bolls, and in this situation feeds upon the exposed seeds, in the month of August and of September. *Nausibius (Sylvanus) dentatus* (42) (Say, 2, p. 325) is also found under bark and in sugar. *Lœmophloeus* (Cucujus) *modestus* (43) (Say, 2, p. 327), a very minute chestnut-brown beetle belonging to the same family, was taken in hemp-seed, the interior of which had been entirely eaten out, and only the husk left.

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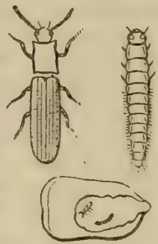

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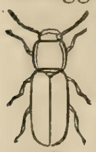


43.

Family twenty-one, *Cryptophagidæ* (44); twenty-two, *Derodontidæ;* twenty-three, *Lathridiidæ;* twenty-four, *Othniidæ;* and twenty-five, *Mycetophagidæ*, will be passed over, as they contain no insects at present known to be injurious to the crops, living principally on fungi, under bark, or in rotting vegetable substances.

The twenty-sixth family, *Dermestidæ*, (45) consists of small oval insects, some of which are found in dried animal remains, others on plants only, and many of them are very destructive to objects of natural history, skins, bones, fur, feathers, books, &c. Lennis states that the European species, *Byturus tomentosus*, (46) is in the habit of frequenting flowers, and that the larva feeds, in June or July, on the fruit of the raspberry, and, from its habits, is called in Germany *Himbeer-made*, or the raspberry maggot. Kirby and Spence state that the perfect insect eats through the footstalk of the blossom of the raspberry, so as sometimes to prove fatal to the whole crop. Blackberries are also attacked in a similar manner. *Byturus unicolor* (47) (Say, 2, p. 126), of this country, is a small insect of a light brown color, found frequently in flowers. *Dermestes vulpinus*, (48) a small beetle of a blackish-brown color, is found in almost every country, and at one time was so injurious to the large skin warehouses in London that a reward of £20,000 was offered for an available remedy, without, however, any being discovered. This insect is also injurious to cork, and sometimes very destructive in collections of natural history, entomology, &c. *Dermestes lardarius* (49) is of a yellow and bluish-black color, and destroys furs, meats, &c., and also is very injurious to collections of natural history. The larva sheds its skin several times, and is covered with bristly hairs; it usually creeps on the surface of the meat, preferring the fat parts,

47.

48.

49.

and does not bury itself in its food until about the time of assuming the pupa state, in which state it remains from three or four days to a week, according to the warmth of the locality (Horn). *Anthrenus (destructor*, (50) Mels.) *varius* (Fab.) is a very pretty insect when examined with a magnifying-glass, being beautifully marbled or variegated with black and gray. The beetle frequents flowers; a great number were taken, May 23, on the flowers of a spiræa; and they are veyr common on umbelliferous plants. Westwood states that they are nearly a year in attaining their full size; but Dr. Horn says that,

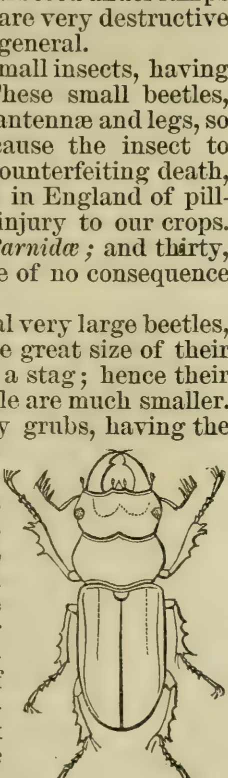
50.

the egg being deposited in any fissure, the larva state requires only about two weeks and the pupa only four or five days. They shed their skins as larvæ several times, and it is during the warm weather that their ravages are most extreme. The larva, when changed into a pupa, retains the last skin of the larva, which serves as a cocoon, a slit having first been made down the back, out of which the perfect beetle makes its escape. Westwood recommends that, when collections of insects are attacked, these pests may be destroyed by putting them in tin cases, which may then be immersed in boiling water, whereby both the larvæ and eggs are at once destroyed. He also states that they appear to be insensible to the effects of camphor, and he actually found them harbored under lumps of that material in his drawers. These insects, also, are very destructive to dried skins, and collections of natural history in general.

The twenty-seventh family, *Byrrhidæ*, consists of small insects, having their body short, oval, or rounded, very convex. These small beetles, at the slightest appearance of danger, fold up their antennæ and legs, so that these members are entirely concealed, and cause the insect to appear like an oval seed or pill, at the same time counterfeiting death, as a means of defense; hence their common name in England of pill-beetles. They are not known, however, to do any injury to our crops.

Family twenty-eight, *Georyssidæ;* twenty-nine, *Parnidæ;* and thirty, *Heteroceridæ*, generally live in or near water, and are of no consequence to the farmer.

The thirty-first family, *Lucanidæ*, comprises several very large beetles, the males of some of which are distinguished by the great size of their mandibles or jaws, which have the appearance of a stag; hence their common name of stag-beetles. The jaws of the female are much smaller. The eggs are oval, and the larvæ are large fleshy grubs, having the extremity of the body curved towards the breast, so as not to allow the insect to creep on a level surface, but compelling it to lie on its side. Their legs are six in number, and very weak; the larva feeds on wood; and, on arriving at its full size, it forms a cocoon of the chips or dust it has gnawed; and in this cocoon the pupa is formed, the male having the large jaws folded on the breast and belly, protecting the antennæ and legs; it is supposed that this insect remains several years in the larva state, one of the European species, according to Rözel, not appearing as a perfect stag-beetle until a lapse of six years. The larva of our native species, *Lucanus dama*, (51) commonly known as the horn-bug, or stag-beetle, (Harris, p. 44, Fitch, 3d Rep., 1856, p. 329,



51.

and 5th Rep., p. 794), is found in old decaying trunks and roots of trees, where it feeds upon the wood; the pupa is formed in large pods or cocoons made of the loose dust and dirt of the tree, and the perfect

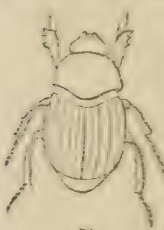
beetle appears from June to August, and feeds upon the sweet sap of trees, &c.; it is also said sometimes to be predaceous, and to destroy soft-bodied insects for the sake of their juices.


52.

The trees principally attacked by the larva are the apple, cherry, oak, and willow. *Platycerus quercus* (52) is a much smaller insect of the same family, of a blackish color, and is found in the rotten wood of oak. *Passalus cornutus*, (Lec.), (53) is a large black beetle, and is very common in Maryland: in old oak stumps and logs, in the spring.


53.

The thirty-second family, *Scarabæidæ*, contains insects, the hind legs of which are placed so near the extremity of the body as to give the beetle a most extraordinary appearance when walking; this peculiar formation is nevertheless particularly serviceable in rolling the balls of excrementitious matter in which they inclose their eggs. These balls are at first irregular and soft; but, by degrees, and during the process of rolling along, become round and harder; they are propelled by means of the hind legs, the insects occasionally mounting to the top when they find a difficulty in urging them along, probably to destroy their equilibrium: sometimes in rolling these balls the beetles stand almost on their heads with their heads turned from the ball. These maneuvers have for their object the burying of the balls in holes, which the insects have previously dug in the earth for their reception, and it is upon the dung, of which the balls are composed and thus deposited, that the larvæ feed when hatched out; the males as well as the females assist in rolling these balls.


54.

The type of this family is the *Scarabæus*, or sacred beetle of the Egyptians, *Ateuchus Ægyptiorum* of Latreille. The best known and most common beetle of this family in this country is the *Canton lævis*, (54) usually termed the tumble-bug. These insects may be seen almost any fine summer day on the public roads in the country, employed in rolling balls of manure, formed from the excrements of horses and cattle in the highway. Another well-known insect in the middle or more southern State is the *Phanæus carnifex* (55) (Lec.): this beetle is of the most beautiful metallic green, purple, and gold colors, but of a very disgusting odor when handled. The males of this species are furnished with a long, recurved horn on the head, the use of which is unknown. This insect feeds also on manure and excrements in the larva state.


55.

The *Aphodiini* (56) are small beetles of an oblong or oval form, of obscure black and brown colors, and may be found swarming, during the spring months, in or about the dung of herbivorous animals or about manure. *Aphodius fimetarius* (56) is a well-known beetle of this tribe, which Doctor Leconte says "has been introduced from Europe, but now is perfectly naturalized, especially in the northern parts of this country."

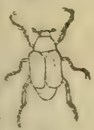

56.

The tribe *Geotrupini* are beetles of a rounded form, living in excrements and manure. Our native insect, *Geotrupes splendidus*, (57), is a beetle of moderately large size, and is remarkable for its beautiful green and golden metallic colors; it is found also in manure and excrements. The tribe *Trogini* (58) consists of oblong, convex insects, frequently with very rough or rugose wing-


57.


58.

cases; they live in dried decomposing animal matter, and when disturbed have the faculty of counterfeiting death; they are able also to produce a creaking noise by alternately rubbing the front part of the mesothorax against the prothoracic cavity, or more probably the extremity of the body against the elytra or wing-cases. *Trox terrestris*, (58) (Say, 2, p. 295) is an example of this tribe. The insect is of a blackish color. The sub-family *Melolonthidæ* feed exclusively on vegetable matter. *Hoplia debilis*, (59) (Lec. Jour. Acad. 2d, p. 285), a small dark-colored beetle, was found very abundant on the foliage, and especially on the flowers of the pear in Maryland, in the spring. Westwood states that the European *Hoplia*, when disturbed, counterfeit death by extending their legs in a stiffened manner, and in different directions. *Dichelonycha* (*hexagona*) *elongatula* (60) (Lec.), or elongated fork claw, (Fitch, 3d Rep., 1856, p. 474), is a small, hairy beetle of a somewhat elongate square form, and of a brown metallic color; and is said to feed upon the foliage of the hazel. Two other species, *D. subvittata* (Fitch, 3d Rep., 1856, p. 475) and *D. linearis* (Fitch, 3d Rep., 1856, p. 475), or "linear fork-claw," are said also to destroy the foliage of the hazel; while *D. albicollis*, (61) or white necked pine beetle, (Fitch, 4th Rep., 1857, p. 747), is said to feed upon the foliage of the white pine. *Comptorhina Omaloplia*) *vespertina* (62) (Harris, p. 33) feeds on the foliage of the sweet briar and rose. *Serica* (*Omalaplia*) *sericea*, (63) (Harris, p. 33; Say, 2, p. 144), a small chestnut-brown beetle, feeds also during the evening in summer on the foliage of the sweet briar and rose; while *Serica iricolor* (64) (Say, 2, p. 145) destroys the foliage of the pear and apple. Say states that this species abounds in hilly and mountainous situations in the month of May, and may be seen flying about among whortleberry bushes in such profusion that, in a very short time, any number desired may be collected; he also says that whenever a female alights on the ground she is immediately surrounded by a number of males.



59.

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63.

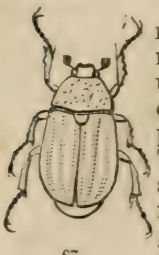
The much-dreaded rose-bug, *Macrodactylus subspinosus* (65) (Harris, p. 37; Fitch, 1st Rep., p. 245, &c.), belongs to the same sub-family. The female deposits her eggs, to the number of about thirty, in the ground in June or July; the larvæ feed upon tender roots, and attain their full growth in autumn; they then descend to pass the winter in a semi-torpid state, below the reach of frost. The pupa is formed in May, in a cell of an oval shape, under ground. The perfect beetle appears in May and June, assembling in great numbers on roses and the flowers of elder, ox-eye daisy, &c., and feeds upon the foliage and flowers of fruit and forest trees. The apple, grape, cherry, plum, peach, oak, and rose, vegetables, maize, grass, &c., do not escape their attacks; and, indeed, these beetles are almost omnivorous. In Maryland they are especially destructive to roses and grape-vines. Their whole transformation, from the egg to the perfect beetle, is completed within the space of one year.

65.

Diplotaxis (melolontha) sordida (66) (Say, 2, p. 299), a small, stoutly built beetle of an oblong, slightly convex form, and of a color from pale chestnut to dark brown, is found in considerable numbers in spring, in Maryland, on the flowers of the pear. The beetles generally known as May-beetles, June-bugs, &c., which are so abundant in certain localities, and do so much injury to the leaves of forest and of fruit trees, belong to this sub-family. These beetles are of a medium size, and gener-

66.

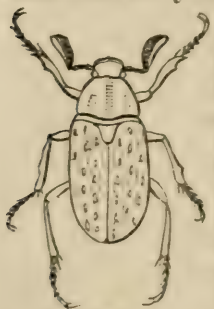
ally of a brown color; there are several species differing but slightly from one another in size, form, or color.



67.

Lachnosterna fusca (Lec.). (67) *(Phyllophaga quercina)* (Harris, p. 30; Fitch, 3d Rep., 1856, p. 368) is one of our most common species. The larvæ are fat, fleshy grubs, and feed upon roots of grass, &c., under the earth, and are frequently very destructive to meadows and pastures. The pupæ are formed in a smooth cell or cavity under ground. The insects are nocturnal in their habits, appearing in May and June, and feed upon the foliage of the apple, elm, maple, oak, cherry, plum, and fruit and forest trees in general. The principal species are *Lachnosterna (Phyllophaga) micans*, (68) *L. hirticula* (69) (Harris, p. 33), *Holotrichia crenulata* (70) (Harris, p. 32), and *Trichestes (pilosicollis) tristis* (71) (Harris, p. 33.) These beetles are all of the same habits, and feed upon the foliage of all the fruit and the forest trees mentioned above. Leunis gives the history of a somewhat allied European beetle, *Mololontha vulgaris*, or cock-chaffer, which may throw some light on our native species. He states that the female, about 24 hours after pairing, creeps into the earth to deposit her eggs, from which, after a period of four to six weeks, the young larvæ hatch, and feed upon roots under ground. These larvæ in four years attain their full size, so that every four years (consequently every fifth summer) they appear in the greatest numbers. Ratzeburg considers it four years, but the Swiss and the Rhine people, on the contrary, think it only a three-years' generation, considering the fourth year an exception (Leunis, p. 457). Köllar, however, states that the female lays 80 to 90 eggs in a heap about six inches under ground; the larvæ appear in about 14 days, and the complete transformation occupies a space of five years; or, if its transformation is retarded by food or weather, sometimes even six years elapse.

71.



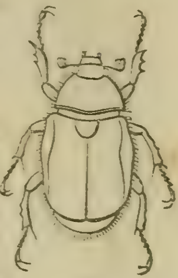
72.

Polyphylla (Melolontha) variolosa, (72) or the scarred melolontha (Harris, p. 33), a large chestnut-colored beetle with lighter marks or scars on the wing cases, is nocturnal in its habits, and feeds on the foliage of elm, maple, oak, apple, cherry, plum, and other forest trees, and fruit trees in general. An insect of the first group, *Anomalæ*, which consists of beetles of small size, is rather common in Maryland. This beetle, *Anomala varians* (73) (Harris, p. 34), appears during the summer months, and feeds upon the foliage of sumach, and both wild and cultivated grape vines. Thirty specimens of this species were taken from the stomach of a king bird, or tyrant fly-catcher *(Tyrannus Carolinensis)*, which had been shot by a Maryland farmer under the mistaken idea that the bird was catching his bees. Another species, *Spilota (Anomala) lucicola* (74) (Fitch, 1857, p. 403), a small chesnut-brown beetle, also feeds upon the foliage of the grape, while a variety of the same insect, *A. pinicola* (75) (Fitch, 1857, p. 747), is said to destroy the foliage of the southern pine. Group 2, *Rutelæ*, contains the spotted pelidnota, *Pelidnota punctata* (76) (Harris, p. 25; Fitch, 1856, p. 403). This insect is a large, livid, chesnut-yellow beetle, with three black spots on each wing cover, and two upon the thorax; it is diurnal in habits, and feeds upon the foliage of both wild and cultivated grapes; it is also accused by some grape-growers of cutting off the bunches, thus injuring the smaller side

74.

bunches, and causing the clusters to ripen unequally. The larva is found in rotten wood.

Cotalpa (Areoda) lanigera, (77) the "woolly areoda," or goldsmith's beetle, is a large insect of a beautiful golden or metallic luster, which, during the day-time, hides under the foliage of trees, and falls to the ground when disturbed. At twilight, however, it feeds upon the foliage of the elm, hickory, poplar, oak, willow, and other forest trees. The larva probably lives in the earth, and feeds upon roots of plants. The second tribe, *Dynastini*, numbers among its foreign members many very large beetles; some of the genera are remarkable for the size and form of the horns on the thorax and head of the males. The larvæ generally are found in rich vegetable mold, or decaying wood. Our native species *Xyloryctes satyrus* (Lec.), (78) a large beetle of a black color, was taken at the root of an ash tree, and also of a sweet gum. *Strategus antæus* (79) (Lec.) burrows in sandy fields (New Jersey), descending to a depth of from one inch to a foot, the females always going deeper than the males. By searching for them early in the morning, they can be captured with greater ease, as the earth around the holes is fresh (Cresson). The beetle is of a brown color. The sub-tribe, *Dynastidæ*, contains one of our largest and finest beetles, *Dynastes tityrus*(80) (Say, 1, p. 9; Fitch, 1856, p. 367), the males of which are distinguished by singular protuberances or horns rising from the head and thorax; they are of a dirty, greenish cream color, having the wing cases mottled or spotted with irregular black blotches. Two perfect males were taken in Washington in a yard containing an old, decaying cherry tree. They were also found by Say in an old cherry tree accidentally blown down near Philadelphia. Mr. Peale states he has also found them in old willows, and Mr. Ridings took many of them from the limbs of an ash in Virginia. The larva, doubtless, feeds upon decaying wood. Tribe 3, *Cetoniini*, consists principally of insects of an oblong, oval, or depressed form, with the wing cases not reaching to the extremity of the abdomen. In regard to this tribe, Mr. Walsh remarks that in coleoptera (beetles), the elytra or wing cases are not, as far as is known, used at all in flight, and some of them, *e. g.*, *Cetonia* and its allies, do not even lift them off their backs when they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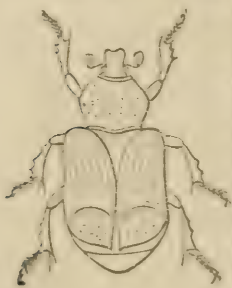
fly. (Walsh. Proceed. Ent. Soc. Phil., vol. 6, p. 121). Westwood states that the beetles frequent flowers, on the juice of which they subsist, the structure of their maxillary lobes enabling them to lap up the sweets. Other species are found on trunks of trees, particularly such as are wounded, and from which the sap flows. A European species, *Cetonia hirta*, (81) is accused of doing much damage to the flowers of the apricot, by eating off the nectary. One of our most common species in Maryland is

82.

Allorhina (Cotinis) nitida (82) (Lec.) This insect is a large beetle, of a velvety green color, with a light cream-colored border or edge. Great numbers of it were taken in Washington from the trunk of a maple which had been wounded accidentally, and from which the sweet juices were flowing: the beetles clustering around the cut like bees, and all busily engaged in lapping up the sap. They also are said to injure the ripe fruit of the beech, by eating holes in the nuts, and in some of the southern States are so very destructive to ripe figs as to have acquired the local name of fig-eaters. *Euryomia (Euphoria) melancholica* (83) is a much smaller beetle, which feeds upon the sap from diseased or injured cotton bolls; it is also found in the flowers. *Euryomia (Erirhipis) Inda*, (84) (Say, 2, p. 141; and Harris, p. 40) is a very common beetle of a brown color, checkered or mottled with a darker tint: this insect also feeds upon the sap of trees, &c. The first brood appears in April and May: and, as they fly slowly and with a loud humming noise near the ground, may at the first glance be readily mistaken for large humble bees. A second brood appears in the autumn, and probably passes the winter in a torpid state. The larvæ probably feed upon the roots of herbaceous plants. The insects themselves frequent the flowers of the golden-rod, (*Solidago*), and feed upon the sap of cotton bolls, maize, locust, &c.: and in the autumn sometimes do considerable damage to the ripe peaches, pumpkins, and figs.

84.

Osmoderma scabra, (85) or rough *Osmoderma*, (Harris, p. 43; Fitch, 1856, p. 329), is a large, somewhat flattened, black beetle, the larvæ of which feed upon wood in old and decaying trees; the pupa is formed in a cell made of the fragments of wood cemented together; and the perfect beetle appears in summer, and is found on the foliage of apple, oak, and other fruits, and also forest trees. These insects when handled emit an odor like that of Russia leather, hence their name *Osmoderma*, from the Greek words signifying scent or odor, and leather. *Osmoderma eremicola*, (86) or smooth *Osmoderma*, (Harris, p. 41: Fitch, 1856, p. 329), is very similar to the foregoing in form and color, but may readily be recognized by its smoother appearance. The beetle feeds upon the sap of trees, apple, cherry, &c.



85.

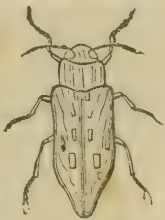
Trichius (Trigonopeltastes) delta (87) (Fab.) is a much smaller beetle, having a very distinct triangular mark of yellow on its black thorax, like the Greek letter delta: the wing-cases are brown, marked with black spots. This insect was found in August and September, feeding on the sweet liquid at the base of the flowers, or on the extravasated sap from injured bolls of cotton. *Valgus (seticollis) squamiger*, (88) (Lec.; Fitch, 1857, p. 695), a small beetle of a

87.

88.

blackish color, was found in great numbers in the month of January, in Maryland, under the bark and in the rotten wood of an old pine stump; the larvæ are fleshy grubs resembling somewhat those of the May-beetle.

The thirty-third family, *Buprestidæ*, contains several species, many of them decorated with the most brilliant metallic tints, and sometimes present the beautiful contrast of yellow spots on a highly polished blue and green ground; these beetles are in general of elongate form. The larvæ usually are fleshy grubs, having the head and first segments of the body very much enlarged or flattened out: they perforate the stems of living plants and trees. The perfect beetles creep but slowly, but are very active when on the wing. They are found partly in flowers or on trees and logs, where they appear to be sunning themselves during the hotter seasons of the year; when disturbed they fold up their legs and antennæ, and fall to the ground. The female has a retractile, horny plate at the end of the abdomen, which she uses for the purpose of depositing her eggs in the chinks of the bark of trees, within which the larvæ reside. *Chalcophora (virginica) Virginiensis* (89) (Harris, p. 48; Fitch, 1857, p. 699), is a rather common species in Maryland; the larvæ burrow in the wood of the pine. Ratzeburg states, of an allied European species, that the larva-state lasts two years; Perris, on the contrary, says only one. This insect is one of the largest species; it is of a dark brassy bronze color, with a bright golden metallic luster; the wing-covers and thorax are beautifully sculptured or indented with deep furrows or lines. A very similar beetle, *Chalcophora liberta* (90) (Fitch, 1852, p. 192,) is also injurious to the wood of pine trees, and may be found on the trunk of pines in summer and autumn. The second group, *Buprestes*, contains species of moderate size, and usually of elongate form. *Dicerca* in general is of a dull bronze color, and is remarkable for the tips of the elytra, or wing-covers, being more or less prolonged, forming a kind of tail. *Dicerca divaricata* (91) (Harris, p. 49; Fitch, 1856, p. 330, &c.), is found from June to August on the trunks and limbs of trees of apple, beech, cherry, and peach, where the larvæ reside, and mine into and destroy the sap-wood under the bark. *Dicerca lurida* (92) (Harris, p. 49; Fitch, 1856, p. 441), injures the hickory in a similar manner, while the larva of *Dicerca punctulata* (Fitch, 1857, p. 706) feeds principally on the wood of the pitch-pine. A beetle answering to *Buprestis (Ancylochira) lineata*, or orange-lined Buprestis of Fitch (4th Rep. 1857, p. 105), was found very plentiful in Washington early in spring. The insect is of a dark bronze color, with three distinct lines of an orange color on each wing-case; in the perfect, or imago state, it feeds upon the tender shoots. *Ancylochira striata*, (95) (Fitch, 1857, p. 703), a beetle of a most beautiful golden metallic lustre, with longitudinally striped wing-covers, is found in summer on the spruce and pine; the larva appears to prefer the dead wood of stumps and logs, and the perfect insect probably feeds on the tender leaves and buds. The insects in group 3, *Anthaxiæ*, are generally of small size, and usually flattened, rarely of linear form. *Melanophila (Chrysobothris) fulvoguttata* (96) (Lec.) and Harris, p. 51), *Trachypteris* (Fitch, 1857, p. 706), in the larva state probably feeds on the wood of the white pine. Group 4, *Chrysobothris*, contains species of rather broad and flattened form, having on their wing-cases impressed bands or spots, and are sometimes of brilliant metallic colors.



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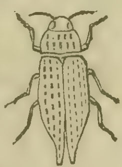

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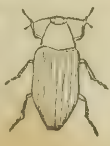

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97.

Chrysobothris femorata, (97) or thick-legged *Buprestis* (Harris, 50; Fitch, 1st Rep., p. 25, &c.), in the larva state bores into the solid wood of the apple, peach, and oak; and the perfect beetle appears from May to July, on the trunks and limbs of the trees, in the sunshine. Fitch states that its original food consisted of the oak. The larvæ are subject to be destroyed by the larvæ of some hymenopterous fly. The larvæ of *Chrysobothris Harrissii* (98) (Fitch, 1857, p. 703) bores into the small limbs and saplings of the white pine. *Chrysobothris calcarata* (99) (Harris, 50), in the larva state is said to bore holes in the trunks of white oak and peach. *Chrysobothris dentipes* (100) (Harris, p. 49; Fitch, 1858, p. 793), or "tooth-legged Buprestis," in the larvæ state feed also on wood, boring holes in the trunk of the oak, or form long, slender, winding passages or serpent-like tracks between the bark and wood of felled timber. The perfect beetle makes its appearance from May to August. Tribe 5, *Agrilini*, are usually slender beetles, but sometimes the body is very broad and flat; in both these cases, however, it narrowed behind. *Agrilus ruficollis* (101) (Say, 2, p. 595) is a small beetle of a narrow form, and in the larva state is said to feed on the pith of the raspberry. Leunis states that the larvæ of some of the European species (102) are injurious to the beech and oak. The larvæ begin their galleries in the one to two inch thick beeches, under the bark, and feed from two to three years; the tree thus attacked withers and dries up. A European species is also mentioned by Westwood as burrowing in the wood of the pear. One of our native species *Agrilus egenus* (103) (Lec.) was found in great numbers in Virginia, feeding upon the foliage of the locust, *(Robinia pseudacacia)*, the leaves attacked being literally riddled with the holes made by these beetles. The insect is very small in size, narrow in form, and of a metallic or bronzed, dark greenish color. The second group, *Braches*, Dr. Leconte states are almost identical with the European *Traches*, and have the body rarely elongated, but usually broad and ovate. Our native species, *Brachys terminans*, (104) (Lec.), is merely mentioned, as its food is not known, from the fact that it is a European species. *Trachys minuta* (105) is said by Westwood to be found on the hazel, upon the leaves of which it is said to feed. Some of our native species may most probably be found in similar situations.

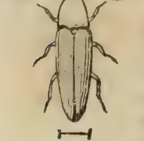

101.


103.


104.

The thirty-fourth family, *Throscidæ*, contains only a few small species; they are found in flowers, and have been classed with the *Eucnemidæ* by some recent authors, but do not possess the power of leaping like most species of the next family, (Lec.). Westwood states that a European species inhabits the wood of the oak.

The thirty-fifth family, *Elateridæ*, is very extensive; a few of the first sub-family, *Eucnemidæ*, and the majority of the third sub-family, *Elateridæ*, possess the singular power of springing into the air when placed on their backs. All are vegetable feeders; the larvæ of some live in the earth, others in rotten wood, while others prey on living plants. The first sub-family, *Eucnemidæ*, is generally composed of small slender beetles, having their antennæ inserted in grooves. *Eucnemis amœnicornis* (106) (Say, 2, p. 628) is found on leaves or under bark; the perfect insects possess a slight leaping power. Some of this sub-family in Europe are found in decaying oak trees. Dr. Horn found *Fornax* in old oak stumps in a state of decay. Sub-family 3, *Elateridæ*, have their antennæ widely separated, and when placed upon their backs possess the power of recovering their natural position by leaping into the air.


106.

Dr. Leconte states that, after folding their legs and antennæ closely together, they extend the prothorax so as to bring the prosternal spine, on the under part of the body, to the anterior part of the mesosternal cavity, then suddenly relaxing the muscles, so that the spine suddenly descends violently into the cavity, the force given by this sudden movement causes the base of the elytra or wing-covers to strike the supporting surface, and by their elasticity the whole body is propelled upwards. This movement, however, can be better observed than described, by any person procuring a large living Elater and placing it on its back on any flat surface. From this habit of suddenly springing into the air, these insects are known in Europe by the common name of "skip-jacks," or "spring beetles," and in America as "snapping beetles," and erroneously "snapping bugs." *Alaus occulatus*, (107) or big-eyed snapping beetle (Harris, p. 54; Fitch, 1856, p. 329, and 1858, p. 794), is so named from two large eye-like spots on the thorax. This insect is very common in Maryland. The larvæ feed on old and decaying wood of oak and apple, and in Maryland have been taken in old pine stumps. *Alaus myops*, (108) or purblind snapping beetles (Fitch, 1856, p. 330), has the eye-like spots on the thorax much smaller and indistinct, and is found also in oak, apple, and pine wood. Mr. Evett, in the Proceedings of the Entomological Society of Philadelphia, vol. 1, p. 227, states that he took this species in the larva state and reared the perfect beetle. In the month of March he collected several larvæ of this species near Philadelphia, in an old pine stump; the pupa was formed about the 25th of July, and the perfect insect came out 7th of August, thus remaining in the pupa state only about thirteen or fourteen days. The well-known fire-fly of the West Indies belongs to this family; it is an Elater *Pyrophorus noctilucus* (109.) Westwood states that this species is upwards of an inch in length, of an obscure brown color, with an oval spot of a dull yellow near each posterior angle of the thorax; these spots emit so strong a light during the night that it is easy to read the smallest writing by placing several of the insects under a glass, or by moving a single beetle along the lines. They are termed, by the natives, Cucuyos or Cucujos, and are said to be attracted by lights. According to Spex, their light proceeds from a phosphorescent substance contained in a small bag in the thorax, filled with an unctuous substance like phosphorus, over which the tracheæ are spread. According to Humboldt and Bonpland, they feed upon the roots of the sugar cane and destroy the plants. Mr. Guilding, however, thinks that the damage done to the plants is in a great measure owing to other insects. This beetle must not be confounded with the fire-fly of Madam Meriam, which inhabits Surinam and other parts of South America, as the latter belongs to an entirely different order. Our common fire-flies, vulgarly termed lightning-bugs, belong also to another family of beetles, which will be spoken of hereafter under the *Lampyridæ*. The larva of *Elater obscurus* (110) is one of the much-dreaded wire-worms of Europe. Westwood states that it is five years in attaining its perfect state, and attacks almost all vegetables and roots. It is readily taken by laying as a bait slices of lettuce or potato wherever the wire-worms are especially troublesome; they burrow into these during the night, and in the morning may be collected and destroyed. The pupa

107.

111.

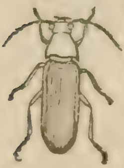
of *Orthostethus infuscatus* (111) (Lec.), a native species, of large size, and chestnut-brown color, was taken from a decaying chestnut log by Dr. Horn, so that we may infer that the larvæ fed upon wood. The group *Agriotes* are insects of moderate or small size. *Agriotes mancus* (112) (Lec.), *A. obesus* (Harris, p. 56), *truncatus* (Melsheimer and Fitch, 1866, p. 527,) resembles the wire-worm of Europe, and the larvæ feed upon grass and herbaceous roots. Leunis states that another European species, *Agriotes segetis*, (113) is very plentiful in fields and meadows, especially in spring, where, under the name of wire-worm, it does much damage to fields of grain by gnawing the roots of the plants, causing them to turn yellow, and the stem to die. The wire-worms of this species also feed upon and destroy the roots of almost all garden vegetables.

112.

114.

The larva of our native *Melanotus (Cratonychus) communis*, (114) (Harris, p. 55), was found in Maryland, in rotten wood; but Dr. Fitch states that it feeds upon the roots of almost any vegetable, grain, or flower. The perfect insect was also taken in Maryland in winter, hybernating under the bark of trees.

The thirty-sixth family, *Cebrionidæ*. The difference between this family and the *Elateridæ*, above mentioned, consists in the greater number (six) of ventral joints, &c. The insects are found flying about at night, and the females at the entrance of holes which they construct in the ground. *Cebrio bicolor* (115) (Lec.) inhabits the southern States, and is of a brown color. Westwood states that the European *Cebrio gigas* is found in abundance after showers of rain.



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The insects of the thirty-seventh family, *Rhipiceridæ*, are found on plants; they fly and walk slowly. The European species, *Rhipicera marginata*, appear, during and toward the end of the rainy season, and is found upon low plants, gnawing the under-stems, but never upon flowers. M. Laporte considers that it undergoes its transformation in decaying trees. The larvæ of one of our native species, *Zenoa (Sandalus) picea* (116) (Say, 2, p. 631), is found under the bark of trees, and *Sandalus niger* (117) (Knoch) is one of the species best known to collectors. Dr. Leconte states, in his classification, that *Sandalus*, especially, affects various cedars.

116.

117.

The thirty-eighth family, *Schizopodidæ*, contains but a single species, found in Arizona, and will therefore be passed over.

The thirty-ninth family, *Dascyllidæ*, consists of insects living on plants usually near water. Our native species, *Odontonyx (Dasytes) trivittis*, (118) is merely mentioned, as the larvæ of a European species of *Dasytes* (119) are spoken of by Leunis as eating out the bottom under the berries of the raspberry. The larvæ, pupa, and perfect insect of *Ptilodactyla elaterina*, (120) a small brown insect, with long beautifully pectinated antennæ, were taken by Dr. Horn from a log, probably of oak, and the pupa were concealed by a thin layer of wood on the side adjacent to the earth. Mr. Walsh, of Illinois, found the larvæ of *Prionocyphon (Cyphon) discoideus* (121) (Say, 2, p. 272) of various sizes, about the end of May, in the hollow of an oak stump containing a gallon or two of water; some were in the decayed wood, which formed

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121.

the lining of the hollow, but most of them were attached to loose pieces of wood and bark which lay at the bottom. The insect is of a pale brownish yellow color, with a large black mark in the center of each wing-cover. The European species, *Cyphon pallidus*, was found in mid-winter, secreted in the stems of reeds. Lennis states that the larvæ of *Cyphon* have long four-jointed antennæ, and that the perfect insects live in flowers.

The fortieth family, *Lampyridæ*, consists of insects of a moderate or small size, of elongate form, and of soft consistence. Many of the species of the second tribe of the first sub-family possess the remarkable power of emitting light, and are here known as fire-flies, or, more vulgarly, lightning-bugs. Our native *Lycus cruentus* (122) (Lec.) is of a reddish orange color, with the ends of the wing-covers tipped with black. These insects in Europe frequent flowers, particularly those of the Umbelliferæ, and also inhabit decayed trunks of trees. *Dictyoptera perfaceta* (123) (Lec.) is an insect of much the same form as the preceding, but is of a black color, having the thorax margined with red. The larva of the European species, *Dictyoptera sanguineus*, (124) was taken under the bark of oak. *Ellichnia (Photinus) corruscus*, (125) a very common species of fire-fly in Maryland, of a black color, having the thorax margined with red, was found abundant hybernating under the loose bark of trees in winter. The larva of some species is mentioned in the "Practical Entomologist," vol. 2, p. 66, as being predaceous, and feeding on various species of borers. In the same work, vol. 1, p. 19, it is stated that the larva of *Ellipolampis (Photinus) pyralis*, (126) an insect having a red thorax with a black mark in the center, and black wing covers, margined with a yellowish color, lives in the earth, and probably feeds upon earth worms. The pupa is said to be slightly luminous, and is formed in an oval cavity in the ground. Westwood states that the body of a European *Lampyris*, (127) the female of which is commonly known as the glow-worm, and is not furnished with wings, is long, flat, and soft, the head small and concealed by the thorax; the legs and antennæ are short; the perfect female presents much the appearance of a larva, from which, however, it is readily distinguished by the greater number of antennal and tarsal joints. The light is emitted by this insect from the under side of the abdomen, several of the terminal segments of which are of a pale color, indicating the extent of the luminous property. The males as well as the pupæ, and even the eggs, are slightly luminous. The glow-worm possesses the singular property of causing its light to cease at will. Of the family *Lampyridæ*, Westwood also states that the female deposits her eggs, which are of large size and yellowish color, in the earth or upon moss and plants, to which they are attached by a viscid substance. It feeds, as does the perfect insect, upon small molluscous animals, especially those of the *Zonitis* (Zone snail,) and not upon leaves or grass. The larva is stated by De Geer to attain its full size in April, when it prepares to assume the perfect state, from the commencement of which period until it becomes a perfect insect fifteen days only are consumed, eight of which are passed in the pupa state. *Phengodes plumosa* (128) (Say, 2, p.634) is a very singular looking insect, of a brownish color, and having the wing-cases exceedingly short and imperfect, these organs being only about one-third of the length of the abdomen. The antennæ are exceedingly beautiful and graceful, and present a very feathery appear-


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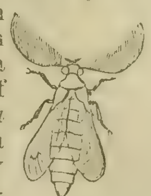
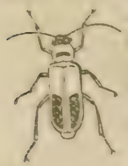

128.

ance, owing to the third and the following joints all emitting very long and flexible branches from near the base. The specimen figured was taken in Maryland at night, having been attracted by a light in the room. Sub-family 2, *Telephoridæ*, consists of insects of a soft consistence, and of a long narrow form. *Chauliognathus Pennsylvanicus*, (129) (Lec.) is very common in the flowers of the cotton, where it probably feeds upon the pollen or nectar, and is stated not to be predaceous. When feeding, it protrudes its maxillary setæ (twice the length of the maxillæ) in the same manner as the tongue of *Lepidoptera*. The insect is of a yellowish color, with a black patch on the thorax; the wing-cases having a larger or smaller black mark at their extremity. These beetles appear later in the season than the *Chauliognathus marginatus*, (Hentz), which resembles it very much, and is likewise found in cotton flowers. Hentz says this insect is also not predaceous, and when about to die generally clasps the petals of a flower with its mandibles, in which position it may often be found dead and dry. This beetle appears earlier in the season than its relative above mentioned. *Telephorus bilineatus* (130) (Say, 2.p. 118) is said to be predaceous, and to feed upon other insects; one of them was taken in Maryland in the very act of feeding on the body of a still living chrysalis of a butterfly which had only just changed from the caterpillar, and the skin of which was yet soft, and not hardened by exposure to the air. Westwood states that the Europeon species are found upon flowers in spring, but are very voracious or predaceous, feeding upon other insects, and even devouring such of their own species as they can overcome, the females not even sparing their own mates. The larvæ reside in moist earth, and are also carnivorous, feeding upon their own species as well as on earth-worms. They pass the winter in the larva state, and change to pupæ in April or May, the perfect insect appearing in two or three weeks. Westwood also says that the snow in Sweden and the mountainous regions of France has been observed to be covered, to a considerable extent, with an immense number of *Telephoridæ*, together with a multitude of other insects, which were supposed to have fallen with the snow, or to have been deposited in such situations by gusts of wind, after violent tempests have defoliated the firs and pine trees. Mr. E. Blanchard, however, suggests that the insects had previously resided in the ground covered at the time by the snow, through which they had crept for the purpose of obtaining a fresh supply of air.



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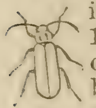
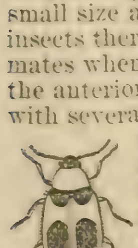


130.

The forty-first family, *Malachidæ*, contains insects having the body soft, oblong or ovate, and but slightly convex. They are generally of small size and very active, being found upon flowers for the sake of the insects there, upon which they feed, the females not even sparing their mates when confined together. Some of the European *Malachius* have the anterior angles of the thorax and the base of the abdomen furnished with several red, bladder-like appendages, which the insect is able to contract or dilate at will. Mr. Curtis thinks these appendages may enable the insect to increase or decrease its gravity during flight. Kirby and Spence regard them as being employed for the purpose of alarming their enemies, but Westwood considers them as a portion of an apparatus for emitting an offensive effluvia to be used for a similar purpose. *Collops quadrimaculatus* (131) (Lec.) is a common species in Maryland, found on flowers. The insect is of a small size, and of a bright red color, with four black marks on its wing covers. The



131.

forty-second family, *Cleridæ*, contains insects seldom exceeding one inch in length; they are generally handsomely variegated in their colors; some of them frequent flowers; others are found upon or under the bark of old trees, stumps, dry wood, &c., where they have passed the larvæ state, during which time as larvæ they are predaceous, and feed upon the larvæ of wood-eating insects. The first group, *Tilli*, are generally of very long and slender form. Our native species, *Cymatodera (Tillus) undulata* (133) (Say, 2, pp. 282,638.) is of a black color, with the thorax margined with red, &c.; it is said to have the habits of a *notoxus*, and was found hybernating in late winter under bark. The larva of the European species, *Tillus ambulans* (134) is found in oak. The sub-group 2, *Cleri*, (135,) contains insects generally with more or less bright red colors, barred with black or yellow. They frequent flowers, the honey of which they extract by means of their beautifully ciliated maxillæ. Westwood states that in the larvæ state they are of a red color, and are very destructive to bees and wasps, in the nests of which the females deposit their eggs during the absence of those insects, and upon the grubs of which the larvæ feed: when first hatched, the larva devours the grub of the bee in the cell in which it was born, and then proceeds from cell to cell, preying upon the inhabitants of each, until it arrives at maturity. It then makes a small cocoon, in which the pupa is formed, and the perfect insect, when fully developed, escapes from the nest, the hardness of its covering sufficiently protecting it from the stings of the bees. The European species (136), *Clerus apiarius*, selects the hive bee, while *Clerus alvearius* (137) chooses the mason bee as food for its young; while *Clerus (Thanasimus) formicarius*, (138.) also European, according to Leunis, is found upon rotten or newly felled timber, especially of fir, under the bark of which the larvæ reside, devouring and destroying wood-boring insects. In the Practical Entomologist, vol. 2, p. 47, the larva of our native *Thanasimus (Pseudoclerus) nigripes* (139) (Say, 2, p. 122) is said to prey upon the larva of *Hylesinus aculeatus*, a wood-boring beetle; and the insect itself has been taken under the bark of trees in Maryland in winter. The beetle has the thorax and upper part of the wing-covers of a red color, while the lower part of the elytra is black, barred with a creamy yellow. Our native *Pseudoclerus ichneumoneus* (140) (Fab.) was found, in almost incredible numbers, in the interstices of the bark of red oak, by Mr. Fay, in winter, and also was taken in Maryland under the bark of trees. The colors of this insect are also red, black, and yellow, but differently marked from T. *nigripes*, above mentioned, and is also somewhat larger in size. Group 3, *Hydnoceri*, contains small insects having somewhat the form of *Cicindela*, and are found on the leaves of trees; they are very active, and take wing easily. *Hydnocera (Clerus) humeralis* (141) (Say, 2, p. 122) is not uncommon in Maryland; it is a very small insect of a black color, with two red patches on the upper and outer edge of the wing-covers. *Orthopleura damicornis* (142) (Lec.), *Enoplium thoracicum* (Say, 2, p. 120, &c.,) is a small beetle of a black color, with red head and thorax; the antennæ have three projecting processes, somewhat resembling the horns of a stag, hence its name. It was found in Maryland, on logs cut for fire-wood in the spring. Of the group 2, *Corynetes*, Dr. Leconte says that our species of *Necrobia* have been introduced from Europe; they feed on animal material in houses, and on carrion in the open air. *Corynetes (Necrobia) rufipes* (143) (Fab.) is a very small beetle of a metallic greenish color and brownish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legs, and was found in cheese in Maryland; while *Necrobia violaceus* (144) is taken on dried meat and carrion; it also frequents flowers. Leunis states that this beetle is a cosmopolite, and in both larva and perfect state it is predaceous and destroys other insects.

The forty-third, family *Lymexylidæ*, contains the much-dreaded insect *Lymexylon navale* (145) of Europe, which is so destructive to ship timber in Northern Europe. The third joint of the maxillary palpi of the male of this species emits numerous long and pilose branches, like a piece of coral. The use of these appendages is as yet unknown. The larvæ feed on wood, and are very common in oak forests in Northern Europe, the timber of which it perforates and greatly injures; it was, indeed, so abundant in the dock-yards of France and Sweden as to occasion much damage. In order to guard against their attacks, it has been suggested to sink the timber under water at the time of the appearance of the insect in its perfect or beetle state. No danger, however, is to be apprehended from our native species. *Lymexylon sericeum*, (146) or silky timber beetle (Harris, p. 58; Fitch, 1857, p. 792), which also feeds on wood, and makes long cylindrical burrows in oak and other forest trees. This insect is of a brown color, with a silky appearance. The larvæ of *Hylocœtus Americanus* (147) (Harris, p. 59; Fitch, 1858, p. 792) also feed upon the oak and other forest trees.


146.


148.

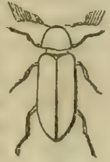
Some of the forty-fourth family, *Cupesidæ*, also probably feed on wood, as our native species, *Cupes concolor* (Lec.) (148) *C. cinerea* (Say, 2, p. 643), is found under bark of decaying trees, and is common about old frame houses. The color of the insect is yel lowish brown, variegated with blackish.

The forty-fifth family, *Ptinidæ*, (149) contains insects of small size, of oval or sub-cylindrical shape, generally short and obtuse at each end; their colors are usually obscure; when touched, they counterfeit death; their movements are slow, and it is not often that they make use of their wings. These insects are found in wood of old houses, furniture, rotten palings, stumps of trees, &c., which they and their larvæ perforate with round holes in every direction; these holes are filled with a very fine powder formed from the gnawed wood and with their excrements. The larvæ of some also destroy grain, skins, and collections of natural history. Dr. Leconte states that these insects have been transported by commerce over the whole globe. The larvæ of *Ptinus fur* (150) (Linn.), *humeralis* (Say, 2, p. 641), are very destructive to woolen cloths, grains, collections of dried plants, insects, stuffed animals, as birds, &c.; and also, according to Audouin, in provisions of flour and meal. This insect is sluggish during the day, but at night commits its depredations, and may be attracted by moistened plant stems or pieces of linen at night, then shaken out and killed in the morning. The beetle is very small, with long antennæ, and of a light chestnut-brown color, with whitish markings on its wing-covers. *Canocara oculata* (Lec.), (151) *Dorcatoma similis* (Say, 2, p. 642), was found by Mr. Jacob Stauffer in puff-balls (fungi). The larvæ of *Sitodrepa* (Anobium) *panicea* (152) are of a whitish color and curved form; when full grown they construct for themselves a cocoon of soft silky matter, mixed with the substances on which they have fed; before


150.


152.

changing into the pupa state it appears that the larva has the instinct to continue the boring of its burrow until it has nearly reached the surface, so that only a small barrier remains, which the beetle can pierce without difficulty. The perfect insects generally appear during the hottest part of summer. Dr. Horn states that the pupa state only lasts four or five days. Both larvæ and perfect insects feed upon stale bread, oatmeal, ship-biscuit, specimens of natural history, ginger, rhubarb, red or Cayenne pepper, and even cantharides or the blister flies of the druggists. In Maryland they have been found in great numbers in stored wheat. The insects *Anobium tesselatum* and *striatum*, in Europe, have acquired the common name of "death-watches," from the noise which they make during the pairing season by striking their jaws on the object upon which they are stationed, by way of signal to their mates, which is answered in the same manner by the other sex. The noise thus produced somewhat resembles the ticking of a watch, and is regarded by the common people as a superstitious omen. Our native insect *Ptilinus ruficornis* (153) (Say, 2, p. 119) is merely mentioned here; as a European species, *Ptilinus pectenicornis*, according to Leunis, is called by the Germans "book-worm," from the destruction it effects in books. The larvæ also burrow into wood, piercing it in every direction with cylindrical burrows; it attacks oak, beech, maple, and hazel. The antennæ of our native *P. ruficornis* appear beautifully pectinated at the ends when examined with a magnifying glass; the insect is of a dark brown color, with rufous legs and antennæ.



153.

Sub-family 3, *Bostrichidæ*, consists of insects elongate in form, with their heads usually deflexed and protected by the thorax, which forms a kind of hood. In the tribe *Psoini*, however, the head is prominent, and not covered. The first tribe, *Endecatomini*, have the thorax with a distinct lateral margin; our native species *Endecatomus rugosus* (154) (Lec.) is found in fungi, and has been also taken under the bark of tulip poplars. The insect is of a dark or brownish black color, and has the wing-covers rugose or rough.

154.

The second tribe, *Bostrichini*, consists of insects small or moderate in size, of a cylindrical form, with head deflexed, and covered by the hood-like projection of the pro-thorax. *Synoxylon* (*Apate*) *basilare* (155) (Say, 2, p. 180), or the red-shouldered apate (Fitch, 1856, p. 441), bores in hickory wood to a considerable depth, preferring the hard central wood. The pupa state is assumed without any special preparation, and the perfect insect when fully formed turns at almost a right angle and emerges through a hole in the bark; the transformations from the larva to the pupa state are made in a very short space of time (Dr. Horn). Dr. Fitch states that this insect bores small holes toward the heart of the trunk, and the pupa is formed at the end of this burrow; the beetle attacks the shag-back hickory, and has also been taken in Maryland from the elm.

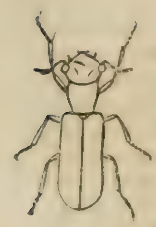
155.

The color of the beetle is black, with a red patch on the upper part or shoulder of each wing-case. The larvæ of *Amphicerus* (*Apate*) *bicaudatus* (156) (Say, 2, pp. 180 and 622), or apple-twig borer of Dr. Fitch, 1856, p. 330, perforate the twigs at the buds, making holes some inches in length in the heart-wood, thus causing the twigs to wither and die. The insect is of a dark color.

156.

157.

Rhizopertha pusilla (Lec.), (157) a very small brown beetle, is said by Dr. Leconte to be found in wheat. Tribe 3, *Psoini*, consists of insects of large or moderate size, having the head prominent. The



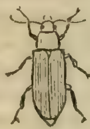
158.

specimen figured, *Polycaon Stoutii*, (158) was sent to Mr. Ulke, from Fort Tejon; of its habits, however, nothing is known.

As the first part of Dr. Leconte's valuable classification ends here, and the second part has not yet been published, the arrangement of the families, &c., is continued from Dr. Leconte's list of the Coleoptera of North America, part 1st, published by the Smithsonian Institution, taking, however, only such beetles as may be interesting to the young entomologist, from either their habits or their food.

The family *Tenebrionidæ* consists of insects generally of an oblong or ovate form, depressed or but slightly elevated, having the thorax square or trapeziform, and as broad behind as the base of the wing-cases (Westwood). Some of these insects are found in wheat, others in decaying vegetable substances, in fungi (Boleti), and under bark of trees. The larva of our native *Centronopus calcaratus* (159)(Lec.) inhabits black-oak stumps; the pupa state lasts only about two weeks (Horn). The color of the beetle is black. The larva of *Xylopinus saperdoides* (160) (Lec.) also inhabits black-oak stumps; and the beetle, which is of a dark brown color, has been taken from under the bark of trees in midwinter in Maryland. The well-known meal-worm is merely the larva state of a black beetle, *Tenebrio molitor*, (161) which frequents bake-houses, corn-mills, and granaries, where it does much injury by devouring meal, flour, bran, &c.; it is also very destructive to ship-biscuits packed in casks, which when opened are found to be eaten through by these larvæ and beetles. The larvæ change or shed their skins several times, and are about an inch in length, of a cylindrical and linear form, very smooth and glossy, and of a yellowish orange color. The pupa is formed without the larva previously making any cocoon, and the perfect insect comes forth in about six weeks, more or less, according to the heat of the weather. These meal worms are bred by bird fanciers in Europe in close earthen or metallic vessels containing stale bread, flour, &c., &c., for the purpose of feeding nightingales, &c., and in this country would be an excellent change of diet for caged mocking-birds. Mr. Curtis states that an allied species, *Tenebrio obscurus* (162) (Lec.), probably does more damage than the above-mentioned insect, as the *Tenebrio molitor* prefers damp and damaged flour; whereas *T. obscurus* prefers that which is dry and sound. This insect is found in all three stages of larva, pupa, and perfect insect at the same time. The European beetle, *Uloma cornuta*, is said also to be grain-feeding in its habits, and to be found in bake-houses in London. Our native species, *Uloma culinaris* (163) and *impressa*, were taken under the bark of trees in Maryland, in spring; both of these beetles are of a brown color. *Boletotherus* (*Boletophagus*) *cornutus* (164) (Lec.) was found in fungi in Maryland. *Hopolcephala bicornis* (165) (Lec.), so called from the two horn-like processes on the head of the male, is a very small, metallic green-colored beetle, very common in Maryland, under bark of trees or in *Boleti*, in the spring. *Hypophlæus parallellus* (166) (Lec.), a very small brown beetle, was found in passages and holes, gnawed under the bark of pine, in Maryland. *Helops micans*, (167), a medium size, or rather

159.



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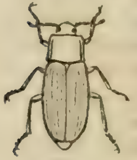
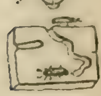


161.

164.



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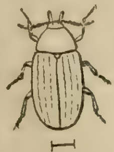
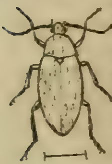


165.

large beetle, of a beautiful metallic green and bronze color, was taken from under the bark, or in decayed cavities of oak trees, in spring. These beetles were frequently found collected together, to the number of eighteen or twenty, in one hole. Many of the family, *Cistelidæ*, are found upon flowers or leaves, or in hedge rows; their larvæ are said to reside in rotten wood. The larva of the European species, *Cistela ceramboides*, was found in oak, in the month of

167.

March. Our common species, *Cistela sericea* (168) (Say, 2, p. 159), is very common in Maryland, on flowers in late summer and autumn. The insect is of a brownish or clay color. The *Lagriidæ* have the head and thorax considerably narrower than the wing-cases, which are of a soft and flexible consistence. The insects are found in Europe in woods and hedges, or upon various plants. Like the cantharidæ, their bodies



168.

are soft, and their motions, when on the wing, are active, although they creep but awkwardly: when disturbed they are said to possess the power of counterfeiting death. Lyonnet states that the larvæ of the European species, *Lagria hirta*, is found under dead oak leaves, on which it feeds. Our native species, *Anthomacra aenea* (169) (Lec.), was taken on flowers. The larvæ of the family *Pyrochroidæ* are generally found under the bark of trees or in rotten wood. The European species, *P. coccinnea*, (170), is found under the bark of birch and in the trunks of decaying oaks.

169.

The imago of our native species, *Pyrochroa flabellata* (170) (Lec.), was taken in flowers. The wing-covers of this beetle are of a black color, while the thorax, head, and feet are reddish. Westwood states that our species *Pyrochroa dendroides* (West.), *Dendroides canadensis* (171) (Lec.), is extremely rare in North America, and was found by Messrs. R. and C. Lewis in May, beneath the bark of maple trees, of which the cross-ways of the great Huron road are made. The males are distinguished by their beautifully plumose antennæ. One of the family, *Anthicidæ*, *Notoxus monodon* (172) (Lec.), is a small beetle of very remarkable form, having the front

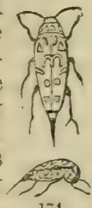
171.

part of the thorax projecting somewhat like a blunted horn over the head; this peculiarity is not confined, as in some of the *Lamellicorn* beetles, to the male alone. This insect is of a blackish color, with red thorax, and was taken plentifully on the flowers of cotton. The *Melandryini* reside chiefly under the bark of trees; the larvæ of *Synchroa punctata* (Lec.) (173), *Melandrya umbrina* (Mels.), live in rotten oak stumps, and the pupa state lasts about a week (Horn). The beetle is of a brown color.

172.

173.

Insects of the family *Mordellidæ* have the body elevated, and arched with their heads inserted very low; in habits they are active, fly with rapidity, and leap well. The larvæ of the European species, *Mordella pusilla*, (174), is found in the stems of the *Marrubium vulgare*, or horehound, feeding upon the medullary substance; the pupa is formed in June, and the imago in July. Our native species, *Mordella octopunctata*, (174), is taken on flowers in Maryland, and is a small beetle of a black color, beautifully variegated and marked with yellow.



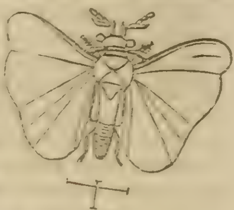
174.

The family *Rhipiphoridæ* are probably parasitic in their habits, as the European species, *Rhipiphorus paradoxus* is said to inhabit the nests of the common wasp; hence Latrielle observes it has been inferred that it subsists in that situation in the larva state, and is probably nourished

by the wasps as their own offspring. Westwood also states that the larger specimens, which are much more rare than the smaller ones, are uniformly found only in the cells of the female wasps. The larvæ of another European species, *R. bimaculatus*, (175) reside in the roots of the field eryngo (*Eryngium campestre*), which is perforated in the center; it is not, however, impossible that these larvæ may be parasitic on some larva, residing in such situations. When full grown it works its way out of the root, and forms a pedunculated cocoon the size of a nut, attached to the stem of the plant. Our native species, *Rhipiphorus Sayi* (175) (Lec.), *bicolor* (Say, 2, p. 163), is rather common on flowers.

175.

The family *Stylopidæ*, (176) contains only very small insects, which, at the first glance, do not appear to belong to the Coleoptera, or beetles, at all. These insects are of a dark or black color, and are parasitic on bees and wasps, between the rings of the abdomen of which their larvæ, according to Leunis, run about or spring like *Podura* (spring tails). The perfect insect has, however, been observed to work its way out of the body of the bee, on or in which it had formerly resided.



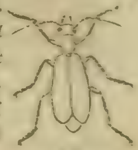
176.

The family *Meloidæ* is distinguished by the head being dilated behind the eyes, and then suddenly narrowed into a small neck, and by the claws of the tarsi which are bifid (cloven in two). These insects are much variegated in their colors, and generally of moderate size; some, however, are quite large; in the larva state they subsist upon vegetable substances: a few, however, are parasitic upon other insects in the larva state. A portion of them counterfeit death when alarmed, while many emit a thick yellowish fluid from the articulations of the legs, &c., of an unpleasant scent. Many of these beetles possess strong vesicatory powers, and are employed externally for the purpose of raising blisters. Our native species, *Meloe angusticollis* (177) (Say, 2, p. 166), or "narrow-necked oil beetle," (Harris, p. 140) is of a steel blue color, and found on butter-cups in the autumn; it has likewise been taken on the leaves of the common potato. Westwood states that the females of an European *Meloe* burrow into the earth, and there deposit a large mass of yellow eggs, agglutinated together. The larvæ when hatched are exceedingly active in their movements, and attach themselves to flies, bees, &c., which, it is said, they suck. Latrielle suggests that these larvæ mount upon the bodies of bees, &c., in order to be carried by them into their nests underground, where they feed upon the food laid up as a store for the young bees; this opinion has also been adopted by Erichson and Brandt, but Westwood thinks that all these authors neglect the fact that the larvæ are also found upon *Syrphidæ* and *Muscidæ* (two-winged flies) as well as upon bees. Leunis states that the female, in the spring, lays at intervals of two to three weeks her numerous eggs in a hole in the ground, which she excavates in sunny places; after four or five weeks the young are hatched, of a yellow color, and strikingly resemble fleas. They then creep to the flowering plants which are visited by fossorial or digging wasps and bees, also by two-winged flies, that are themselves also parasitic in the nests of *Hymenopterous* insects, and fasten themselves to these insects. The perfect beetles crawl slowly on the ground or among the herbage. *Tigrania (Horia) sanguinipennis* (178) (Say, 2, p. 166) is somewhat rare in Maryland.

177.


178.

Westwood states that the larva of a South American species, *Horia maculata*, destroys the larva of a wild bee (Xylocopa), which makes its cells and deposits its eggs in the trunks of trees. It has been conjectured that the larva of the *Horia* feeds upon the stores of food laid up for the larva of the *Xylocopa*, and which is consequently starved to death. *Macrobasis Fabricii* (179) (Lec.), *Epicauta* or *Cantharis cinerea* (Harris, p. 138), is exceedingly common, and feeds on the foliage of honey and common locust, wild indigo, potato, English bean, &c., &c. It also has been accused of injuring the young fruit of the apple. The perfect insect is of a grayish ash color. The egg is deposited in the ground by the female, and hatches in about a month; the larvæ live under ground on roots, &c., while the perfect beetles, during the summer at night or in cloudy weather, devour the foliage; during the day-time they bury themselves in the ground or hide under leaves, moss, grass, &c., eating mostly in the mornings and evenings. This species of beetle is said to be exceedingly destructive in Massachusetts.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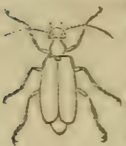

180.

The black Cantharis, or Blister-fly, *Epicauta pennsylvanica* (Lec.), (180) *Cantharis atrata* (Harris, p. 139), devours the foliage of the potato and various flowers, such as the China-aster, and is very abundant in the flowers of the golden-rod (Solidago). *Epicauta cinerea* (Lec.), (181) *Cantharis marginata* (Harris, p. 147), or the "margined cantharis," so called from the light ash-colored margin around the wing covers, devours the foliage of the clematis and butter-cup, mostly near the ground. *Epicauta (Cantharis) vittata* (182) (Harris, p. 137), or striped Cantharis, is of a yellow orange color, having two black, longitudinal stripes on each wing cover; it destroys the foliage of the potato and other vegetables; it also is very destructive to various flowers. *Epicauta strigosa* (Lec.) (183) was found in South Carolina, eating holes in the flowers of cotton. *Pomphopœa (Lytta) Aenea* (184) is of a dark color with something of a metallic lustre, and was taken in Maryland in May, as it was just emerging from the earth. The larva of the European species of *Zonitis* (185) is said by Latrielle to inhabit the nests of certain bees in the spring. Our native *Zonitis (Nemognatha) atripennis* (185) was taken on flowers in Maryland. The wing cases of this insect are of a dark or blackish color, while the head, thorax, and part of the legs are red.


181.

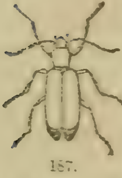

182.


185.


184.

Of the habits of the family *Cephaloidæ* little is known. Our native *Cephaloon lepturides* (186) (Lec.) was taken on flowers; the insect is of a dirty brown color.

The family, *Oedemeridæ*, (187) often have the body long and narrow, with the wing cases broader than the head and thorax. They frequent flowers, especially those of the umbelliferæ. They fly with agility, but, when walking, their motions are rather slow. Our native species, *Nacerdes melanura* (Lec.), (187) *Oedemera apicalis* (Say, 2, p. 661), is of a red color with the ends of the wing cases black. The perfect beetle was taken on flowers.


187.


186.

The *Mycterida* will be passed over, as their habits are not yet known; the perfect insects, however, have been taken on the leaves of shrubs and trees. Little has hitherto been known also of the habits of the *Pythinæ*. The European species, *Pytho depressus*, (188) is found under the bark of pines in Sweden. Our native species, *Pytho americanus*, (189), was found in Maryland, under the bark of pine trees, in the month of March, in the nests or oval cocoons of the *Rhagium lineatum*, where the larva or pupa of the *Rhagium* had evidently been devoured, most probably by either the larva or the perfect beetle of the *Pytho*. These last-named insects were perfectly fresh, as if only just emerged from the pupa state: at least twenty specimens were taken from one pine log at the same time: and, although all the other logs in the newly cleared field were carefully examined, and almost all had the cocoon of the *Rhagium* under the loose bark, not another *Pytho* could be discovered. As the first part of Dr. Leconte's list of the coleoptera of the United States ends with the Pythidæ, and the second part will probably be published shortly, in which the arrangement of the families, names, &c., &c., of many insects will doubtless be changed, it has been thought advisable to defer finishing this paper until the publication of that work by the Smithsonian Institution.

189.

PART II.

The following is an alphabetical list of some of the principal vegetable and also animal substances, either frequented or injured by beetles, (*Coleoptera*,) with the names of the beetles frequenting them:

As it would occupy too much space, in this necessarily brief list, to enumerate all the vegetable and the animal substances injured by the beetles already mentioned, it may be necessary to state that such only are named in this list as have been already spoken of in Part I, and are either the result of personal observation, or are quoted from the best and most reliable authorities.

Ants' Nests:

Insect, *Scydmænidæ*, partly, (21,)* found in.
Insect, *Pselaphidæ*, partly, (22,) found in.
Insect, *Claviger foveolatus*, Europe, (23,) found in.
Insect, *Histrini*, minute species, Europe, (27,) found in.

Apple, (Pyrus Malus:)

Larva, *Lucanus dama*, (51,) wood.
Insect, *Serica iricolor*, (64,) foliage.
Insect, *Macrodactylus subspinosus*, (65,) foliage.
Insect, *Lachnosterna quercina*, (67,) foliage.
Insect, *Lachnosterna micans*, (68,) foliage.
Insect, *Lachnosterna hirticula*, (69,) foliage.
Insect, *Holotrichia crenulata*, (70,) foliage.
Insect, *Trichestes tristis*, (71,) foliage.
Insect, *Polyphylla variolosa*, (72,) foliage.
Insect, *Osmoderma scabra*, (85,) foliage.?
Insect, *Osmoderma eremicola*, (86,) foliage.?
Larva, *Dicerca divaricata* (91,) eats wood.
Larva, *Chrysobothris femorata*, (97,) eats wood.
Larva, *Alaus oculatus*, (107,) eats wood.
Larva, *Alaus myops*, (108,) eats wood.

* The numbers in parentheses refer to Part I, of this paper.

Larva, *Amphycerus bicaudatus*, (156.) eats wood.
Insect, *Macrobasis fabricii*, (179.) injures young fruit.

APRICOT :)

Insect, *Cetonia hirta*, Europe, (31,) flowers; eats nectary.

ASH, (FRAXINUS :)

Insect, *Xyloryctes satyrus*, (78.) taken near root.
Insect, *Dynastes tityrus*, (80,) taken on root.

ASTER, CHINA :

Insect, *Epicauta pennsylvanica*, (180.) eats flowers.

AQUATIC PLANTS :

Insect, *Hydrophilus piceus*, Europe, (13,) eats foliage, &c.

BACON :

Larva and Insect, *Dermestes lardarius*, (49.)

BARK OF TREES :

Insect, *Pselaphidæ*, some, (22.) found under or feeding upon.
Insect, *Staphylinidæ*, (25.) found under or feeding upon.
Insect, *Histeridæ*, (27.) found under or feeding upon.
Insect, *Nitidulini* (32,) found under or feeding upon.
Insect, *Ipini*, (34.) found under or feeding upon.
Insect, *Trogositidæ*, (35.) found under or feeding upon.
Insect, *Trogosita mauritanica*, (35.) found under or feeding upon.
Insect, *Colydiidæ*, (37.) found under or feeding upon.
Insect, *Aulonium paralellopipedum*, (38.) found under or feeding upon pine.
Insect, *Sylvanus bidentatus*, (40.) found under or feeding upon chestnut.
Insect, *Nausibius dentatus*, (42.) found under or feeding upon.
Insect, *Mycetophagidæ*, partly, (44.) found under or feeding upon.
Insect, *Eucnemis amænicornis*, (106.) found under or feeding upon.
Insect, *Melanotus communis*, (114.) found under.
Insect, *Zenoa picea*, (116.) found under or feeding upon.
Insect, *Ellichnia corrusca*, (125,) found under.
Insect, *Cymatodera undulata*, (133.) found under.
Insect, *Pseudoclerus nigripes*, (139.) found under.
Insect, *Pseudo clerus ichneumoneus*, (140.) found under oak.
Insect, *Cupes concolor*, (148.) found under or feeding upon.
Insect, *Tenebrioidæ*, partly, (159.) found under or feeding upon.
Insect, *Xylopinus saperdoides*, (160.) found under or feeding upon.
Insect, *Melandryidæ*, (173.) found under or feeding upon.

BARLEY, (HORDEUM :)

Insect, *Zabrus gibbus*, Europe, (8,) grain.

ENGLISH BEAN, (VICIA FABA :)

Insect, *Macrobasis fabricii*, (179,) foliage.

BEECH, (FAGUS :)

Larva and insect, *Trogosita dubia*, (36,) in nuts.
Larva, *Dicerca divaricata*, (91,) wood.
Larva, *Agrilus viridis*, Europe, (102,) wood.
Larva, *Ptilinus pectinicornis*, Europe, (153,) wood.

CARRION:

Larva and Insect, *Necrophila peltata*, (19.)
Larva and Insect, *Staphylinidæ*, some, (25.)
Larva and Insect, *Creophilus villosus*, (26.)
Larva and Insect, *Histeridæ*, partly, (27.)
Larva and Insect, *Nitidulidæ*, partly, (29.)
Larva and Insect, *Nitidulini*, partly, (32.)
Larva and Insect, *Stelidota geminata*, (33.)
Larva and Insect, *Dermestidæ*, partly, (45.)
Larva and Insect, *Trogidæ*, partly, (58.)
Larva and Insect, *Necrobia*, Europe, (144.)
Larva and Insect, *Necrobia violaceous*, (144.)

CEREALS. (See WHEAT, ETC.)

CEDARS, (JUNIPERUS:)

Insect, *Sandalus*, (117,) affects.

CHEESE:

Larva and insect, *Corynetes rufipes*, (143.)

CHERRY, (PRUNUS CERASUS:)

Larva, *Lucanus dama*, (51,) wood.
Insect, *Macrodactylus subspinosus*, (65,) foliage.
Insect, *Lachnosterna fusca*, (67,) foliage.
Insect, *Lachnosterna micans*, (68,) foliage.
Insect, *Lachnosterna hirticula*, (69,) foliage.
Insect, *Holotrichia crenulata*, (70,) foliage.
Insect, *Trichestes tristis*, (71,) foliage.
Insect, *Polyphylla variolosa*, (72,) foliage.
Larva, *Dynastes tityrus*, (80,) decaying wood.
Insect, *Osmoderma eremicola*, (86,) foliage.?
Larva, *Dicerca divaricata*, (91,) wood.

CHESTNUT, (CASTANEA VESCA:)

Larva, (prob.,) *Sylvanus bidentatus*, (40,) bark; wood.
Larva, *Orthostethus infuscatus*, (111.)

CHINA ASTER:

Insect, *Epicauta* { *Pennsylvanica*, *atrata*. } (180,) flower

CLEMATIS:

Epicauta { *cinerea*, *marginata*. } (181.) foliage.

CORK:

Insect, *Dermestes vulpinus* (?), Europe, (48.)

CORN, INDIAN, (ZEA MAYS.) (See MAIZE.)

COLLECTIONS OF NATURAL HISTORY. (See also FURS, FEATHERS, ETC.)

Larva and insect, *Dermestes caninus*, &c., (48.)

COTTON, (GOSSYPIUM HERBACEUM:)

Insect, *Colastus semitectus*, (30,) in flowers and decaying bolls.
Insect, *Carpophilus hemipterus*, (31,) in flowers and decaying bolls
Insect, *Sylvanus quadricollis*, (41,) in flowers and decaying bolls.
Insect, *Euryomia melancholica*, (83,) sap of boll and flower.
Insect, { *Erirhipis inda*, *Euryomia*. } (84,) sap of boll and flower.

COTTON, (GOSSYPIUM HERBACEUM:)

Insect, { *Trangonopeltastes delta.* / *Trichius.* } (87,) frequents flower.
Insect, *Chauliognathus Pennsylvanicus*, (129,) frequents flower.
Insect, *Chauliognathus marginatus*, (129,) frequents flower.
Insect, *Notoxus monodon*, (172,) frequents flower.
Insect, *Epicauta strigosa*, (183,) destroys flowers.

DECOMPOSING OR DECAYING VEGETABLE MATTER. (See VEGETABLE.)

DECOMPOSING OR DECAYING ANIMAL MATTER. (See CARRION.)

DECOMPOSING OR DECAYING WOOD MATTER. (See WOOD.)

DUNG AND DUNGHILLS. (See MANURE, EXCREMENTS, ETC.)

ELDER, (SAMBUCUS CANADENSIS:)

Insect, *Macrodactylus subspinosus*, (65,) frequents flowers.

ELM, (ULMUS:)

Insect, *Lachnosterna fusca*, (67,) foliage.
Insect, *Lachnosterna micans*, (68,) foliage.
Insect, *Lachnosterna hirticula*, (69,) foliage.
Insect, *Holotrichia crenulata*, (70,) foliage.
Insect, *Trichestes tristis*, (71,) foliage.
Insect, *Polyphylla variolosa*, (72,) foliage.
Insect, *Areoda lanigera*, (77,) foliage.
Larva, *Synoxylon basilare*, (155,) wood.

ERYNGO, (ERYNGIUM CAMPESTRE:)

Larva, *Rhipiphorus bimaculatus*, Europe, (175,) roots.

EXCREMENTS OF HERBACEOUS ANIMALS. (See also MANURE.)

Larva and insect, *Sphæridiidæ*, some, (15.)
Larva and insect, *Histeridæ*, partly, (27.)
Larva and insect, *Canthon lævis*, (54.)
Larva and insect, *Phanæus carnifex*, (55.)
Larva and insect, *Aphodiini*, (56.)
Larva and insect, *Geotrupes splendidus*, (57)

FEATHERS. (See also COLLECTIONS OF NATURAL HISTORY, FURS, ETC.)

Larva, *Dermestidæ*, (45.)

FISH SPAWN:

Larva and insect, *Dytiscidæ*, some, (11.)

FISH, DEAD. (See also CARRION.)

Insect, *Silphidæ*, some, (16.)

FLIES:

Larva, *Meloidæ*, Europe, (177,) parasitic: attached to body.

FLOUR:

Larva and insect, *Ptinus fur*, Europe, (150.)
Larva and insect, *Tenebrionidæ*, some, (161,) moist and damaged
Larva and insect, *Tenebrio molitor*, (161,) moist and damaged.
Larva and insect, *Tenebrio obscurus*, (162,) dry and sound.

FLOWERS:

Insect, *Lebiæ*, (6,) frequent.
Insect, *Staphylinidæ*, some, (25,) frequents.

FLOWERS:

Insect, *Colastus semitectus*, (30.) frequents flowers of cotton.
Insect, *Carpophilus hemipterus*, (31.) frequents flowers of cotton.
Insect, *Nitidulidæ* and *Nitidulinii*, some, (32.) frequent.
Insect, *Byturus tomentosus*, Europe, (46,) destroys blackberry and raspberry flowers.
Insect, *Byturus unicolor*, (46,) frequents.
Insect, *Anthrenus varius*, (50,) frequents.
Insect, *Macrodactylus subspinosus*, (65,) destroys.
Insect, *Cetoniini*, (81,) frequents.
Insect, *Euphoria melancholica*, (83.) frequents cotton, &c.
Insect, *Buprestidæ*, some, (89,) frequent.
Insect, *Throscidæ*, (105,) frequents.
Larva, *Melanotus communis*, (114,) destroys roots.
Insect, *Cyphon*, (121,) frequents.
Insect, *Lycus*, Europe, (122.) frequents umbelliferæ.
Insect, *Chauliognathus*, (129,) frequents.
Insect, *Telephoridæ*, Europe, some, (130,) frequents.
Insect, *Malachiidæ*, (131,) frequents.
Insect, *Collops 4-maculatus*, (131,) frequents.
Insect, *Cleridæ*, some, (132.) frequents, but probably feeds on other insects.
Insect, *Necrobia violaceus*, (144,) frequents, but feeds on other insects.
Insect, *Cistelidæ*, (168,) frequent.
Insect, *Pyrochroa flabellata*, (170.) frequents.
Insect, *Notoxus monodon*, cotton, (172.) frequents.
Insect, *Mordella octopunctata*, (174.) frequents.
Insect, *Rhipiphorus Sayi*, (175.) frequents.
Insect, *Epicauta* { *Pennsylvanica* / *atrata.* } (180.) destroys.
Insect, *Epicauta vittata*, (182,) destroys.
Insect, *Epicauta strigosa*, (183.) destroys cotton, &c.
Insect, *Zonitis atripennis*, (185,) frequents.
Insect, *Œdemeridæ*, Europe, (187.) frequents especially umbelliferæ.
Insect, *Nacerdes melanura*, (187,) frequents.

FOREST TREES. (See OAK, MAPLE, ETC.)

FRUIT TREES. (See APPLE, PEACH, ETC.)

FUNGI:

Insect, *Staphylinidæ*, some, (25.) found in fungi.
Insect, *Carpophilus hemipterus*, (31,) found in minute fungi on cotton and maize.
Insect, *Nitidulini*, some, (32,) found in.
Insect, *Colydiidæ*, some, (37,) found in.
Insect, *Cryptophagidæ*, (44,) found in.
Insect, *Mycetophagidæ*, (44,) found in.
Insect, *Cœnocara oculata*, (151.) in puff-balls.
Insect, *Endecatomus rugosus*, (154.) found in.
Insect, *Tenebrionidæ*, some, (158.) found in.
Insect, *Boletotherus cornutus*, (164.) found in.

FURS:

Larva, *Dermestidæ*, (45.)
Larva, *Dermestes lardarius*, &c., (49.)
Larva, *Ptinus fur*, (150.)

GINGER, DRIED ROOT, (ZINZIBER OFFICINALIS:)

Larva, *Sitodrepa panacea*, (152.)

GRAIN IN GRANARIES. (See also WHEAT, MAIZE, ETC.)

Larva and insect, *Carabidæ*, Europe, some, (3,) injure grain, &c.
Larva and insect, *Pterostichini*, Europe, (7,) injure grain, &c.
Larva, *Zabrus gibbus*, European, (8,) roots and shoots.
Insect, *Zabrus gibbus*, European, (8,) injures grain.
Insect, *Amara*, some, (9,) injures grain.
Larva, *Trogositidæ*, (35,) injures grain.
Larva, *Trogosita Mauritanica*, (35,) injures grain.
Larva, *Trogosita dubia*, (36,) injures grain.
Larva, *Sylvanus Surinamensis*, (39,) injures grain.
Larva, *Agriotes segetis*, Europe, (113,) roots.
Larva, *Ptinus fur*, (150,) grain.
Larva, *Sitodrepa panicea*, (152,) grain.
Larva, *Uloma*, Europe, (163,) grain.

GOLDEN ROD, (SOLIDAGO:)

Insect, *Erirhipis inda*, (84,) frequents flowers.
Insect, *Macrobasis*, { *Fabricii* / *cinerea*, } (179,) frequents flowers.
Insect, *Epicauta* { *Pennsylvanica*, &c., / *atrata*, &c., } (180,) frequents flowers.

GRAPE, (VITIS:)

Larva, insect, *Stelidota geminata*, (33,) in fruit injured by curculio.
Insect, *Macrodactylus subspinosus*, (65,) fruit and foliage.
Insect, { *Spilota* / *Anomala* } *lucicola*, (74,) foliage.
Insect, *Anomala varians*, (73,) foliage.
Insect, *Pelidnota punctata*, (76,) fruit and foliage.

GRASSES, (GRAMINEÆ:)

Insect, *Harpalus caliginosus*, (10,) seeds.
Insect, *Bryaxis*, (24,) found on swamp-grass.
Larva, *Macrodactylus subspinosus*, (65,) on roots.
Larva, *Lachnosterna fusca*, &c., (67,) on roots.

GUM, SWEET; LIQUID AMBER:

Insect, *Xyloryctes satyrus*, (78,) taken near root.

HAZEL, (CORYLUS:)

Insect, *Dichelonycha hexagona*, (60) foliage.
Insect, *Dichelonycha linearis*, (60,) foliage.
Insect, *Dichelonycha subvittata*, (60,) foliage.
Insect, *Trachys (Brachys) minuta*, Europe, (105,) foliage.
Larva, *Ptilinus pectinicornis*, Europe, (153:) wood.

HEMP:

Larva, *Laemophlœus modestus*, (43;) in seed.

HERBACEOUS ROOTS. (See also GRASS, VEGETABLE ROOTS, ETC.

Larva, *Lachnosterna fusca*, &c., (67,) injures.
Larva, *Erirhipis inda*, (84.)
Larva, *Elater obscurus*, Europe, (110.)
Larva, *Agriotes* { *mancus*, / *obesus*, } (112.)
Larva, *Melanotus communis*, (114.)

HERBARIUM:

Larva, *Ptinus fur*, Europe, (150,) dried plants.
Larva, *Sitodrepa panicea*. (152.) dried plants.

HICKORY:

Insect, *Cotalpa lanigera*, (77,) foliage.
Larva, *Dicerca lurida*, (92,) wood.
Larva, *Synoxylon basilare*. (155,) wood.

HIDES. (See SKINS, FURS, ETC.)

HONEY LOCUST, (GLEDITSCHIA TRIACANTHOS.) (See LOCUST.)

HOREHOUND, (MARRUBIUM:)

Larva, *Mordella pusilla*, Europe, (174,) in stems.

WILD INDIGO, (BAPTISIA:)

Insect, *Macrobasis* { *Fabricii*, *cinerea*, } (179,) foliage.

DRIED INSECTS. (See COLLECTIONS OF NATURAL HISTORY, ETC.)

LOCUST, (ROBINIA:)

Insect, *Erirhipis inda*, (84,) sap.
Insect, *Agrilus egenus*, (103,) foliage.
Insect, *Macrobasis* { *Fabricii*, *cinerea*, } (179.)
Insect, *Macrabasis* { *Fabricii*, *cinerea*, } (179,) honey locust.

MAIZE, (ZEA MAYS:)

Larva, *Omophron labiatum*, (2,) destroys young plants.
Larva, *Colastus semitectus*, (30.) in decaying seeds.
Larva, *Carpophilus hemipterus*, (31.) in decaying seeds.
Larva, *Ips quadrisignatus*, (34,) burrows in sweet corn.
Larva, *Trogosita dubia*, *&c.*, (36,) grain.
Larva, *Sylvanus Surinamensis*, (39,) grain.
Larva, *Sylvanus quadricollis*, (41,) grain.
Insect, *Macrodactylus subspinosus*, (65.) foliage.
Insect, *Erirhipis inda*, (84,) sap.

MANURE. (See also EXCREMENTS OF HERBIVOROUS ANIMALS.)

Larva, insect, *Canthon lævis*, (54.)
Larva, insect, *Phanæus carnifex*, (55.)
Larva, insect, *Aphodius fimetarius*, (56.)
Larva, insect, *Geotrupes splendidus*, (57.)

MAPLE, (ACER:)

Insect, *Lachnosterna fusca*, (67,) foliage.
Insect, *Lachnosterna micans*, (68,) foliage.
Insect, *Lachnosterna hirticula*, (69,) foliage.
Insect, *Holotrichia crenulata*, (70,) foliage.
Insect, *Trichestes tristis*, (71,) foliage.
Insect, *Polyphylla variolosa*, (72,) foliage.
Larva, *Ptilinus pectinicornis*, Europe. (153.) wood.
Larva, *Pyrochroa dendroides*, (171.) under bark.
Larva, *Dendroides canadensis*. (171.) under bark.

MEAL. (See also FLOUR, ETC.)

Larva, *Ptinus fur*, Europe, (150.)
Larva, *Tenebrio molitor*, (161.)

MEAT:

Larva, *Dermestes lardarius*, (49.)

MOLLUSKS:

Larva, *Hydrophilus piceus*, Europe, (13.) aquatic mollusks.
Larva and insect, *Lampyridæ*, Europe, (127.) terrestrial mollusks.

COLLECTIONS OF NATURAL HISTORY. (See COLLECTIONS, ETC.)

NAVAL TIMBER. (See TIMBER, OAK, ETC.)

NUTS. (See HAZEL.)

OAK, (QUERCUS:)

Larva, *Lucanus dama*, (51.) wood.
Larva, *Platycerus quercus*, (52.) wood.
Larva, *Passalus cornutus*, (53,) wood.
Insect, *Macrodactylus subspinosus*, (65,) foliage.
Insect, *Lachnosterna fusca*, (67,) foliage.
Insect, *Lachnosterna micans*, (68,) foliage.
Insect, *Lachnosterna hirticula*, (69,) foliage.
Insect, *Holotrichia crenulata*, (70,) foliage.
Insect, *Trichestes tristis*, (71,) foliage.
Insect, *Polyphylla variolosa*, (72,) foliage.
Insect, *Cotalpa lanigera*, (77,) foliage.
Insect, *Osmoderma scabra*, (85,) foliage.?
Larva, *Chrysobothris femorata*, (97,) wood.
Larva, *Chrysobothris calcarata*, (99,) white oak wood.
Larva, *Chrysobothris dentipes*, (99,) wood.
Larva, *Agrilus*, Europe, some, (102,) wood.
Larva, *Throscus*, Europe, some, (105,) wood wainscoting.
Larva, *Eucnemidæ*, (106,) wood.
Larva, *Fornax*, (106,) stumps.
Larva, *Alaus oculatus*, (107,) wood.
Larva, *Alaus myops*, (108,) wood.
Larva, *Ptilodactyla elaterina*, (120,) wood.
Larva, *Prionocyphon discoideus*, (121,) hollow stumps, in water.
Larva, *Dictyopterus sanguineus*, Europe, (124,) under bark.
Larva, *Tillus ambulans*, Europe, (134,) wood.
Insect, *Pseudoclerus ichneumoneus*, (140,) under bark, probably destroying othér insects.
Larva, *Lymexylon navale*, Europe, (145,) ship-timber and wood.
Larva, *Lymexylon sericeum*, (146,) wood.
Larva, *Hylocœtus Americanus*, (147,) wood.
Larva, *Ptilinus pectinicornis*, Europe, (153,) wood.
Insect, *Centronopus calcaratus*, (159,) stumps of black oak.
Insect, *Xylopinus saperdoides*, (160,) stumps of black oak.
Insect, *Helops micans*, (167,) under bark.
Larva, *Cistela ceramboides*, Europe, (168,) in oak.
Larva, *Lagria hirta*, Europe, (169,) dead leaves.
Larva, *Pyrochroa coccinea*, (170,) rotten wood.
Larva, *Synchroa punctata*, (173,) rotten wood.

OATMEAL:

Larva, *Sitodrepa panicea*, (152.)

OX-EYE DAISY, (CHRYSANTHEMUM:)

Insect, *Macrodactylus subspinosus*, (65,) frequents flowers.

PARASITIC ON OTHER INSECTS:

Larva, *Meloidæ*, Europe, (177.)

PEACH:

Insect, *Macrodactylus subspinosus*. (65,) foliage.
Insect, *Cotinus nitida*, (82,) ripe fruit and sap.
Insect, *Erirhipis inda*, (84,) ripe fruit and sap.
Larva, *Dicerca divaricata*, (91,) wood.
Larva, *Chrysobothris femorata*, (97,) wood.
Larva, *Chrysobothris calcarata*, (99,) wood.

PEAR, (PYRUS:)

Insect, *Hoplia debilis*, (59,) frequents foliage and flower.
Insect, *Diplotaxis sordida*. (66,) frequents foliage and flower.
Insect, *Serica iricolor*, (64,) frequents foliage and flower.
Insect, *Cotalpa lanigera*, (77,) foliage.
Larva, *Agrilus*, Europe, some, (102,) wood.

PEPPER, RED, (CAPSICUM:)

Larva, *Sitodrepa panicea*, (152.)

PINE, (PINUS:)

Insect, *Aulonium parallelopipedum*, (38,) under bark.
Insect, *Dichelonycha albicollis*, (61,) white pine foliage.
Insect, { *Spilota*, / *Anomala*, } *pinicola*, (75,) foliage.
Insect, *Valgus squamiger*, (88,) in rotten wood and under bark.
Larva, *Chalcophora Virginiensis*, (89,) wood.
Larva, *Chalcophora liberta*, (90,) wood.
Larva, *Dicerca punctulata*, (93,) pitch-pine wood.
Larva, *Ancylochira lineata*, (94,) wood.
Larva, *Ancylochira striata*, (95,) wood.
Larva, *Melanophila fulvoguttata*, (96,) white-pine wood.
Larva, *Chrysobothris Harrisii*, (98,) wood.
Larva, *Alaus oculatus*, (107,) wood.
Larva, *Alaus myops*, (108,) wood.
Insect, *Hypophlœus paralellus*, (166,) under bark.
Insect, *Pytho depressus*, Europe, (188,) under bark.
Insect, *Pytho Americanus*, (189,) under bark, probably predaceous.

PLANTS NOT SPECIFIED:

Larva, *Elateridæ*, some, (106,) lives on.
Insect, *Rhipicera marginata*, Europe, (116,) gnaws under stems.

PLUM, (PRUNUS DOMESTICA:)

Insect, *Macrodactylus subspinosus*, (65,) foliage.
Insect, *Lachnosterna fusca*, (67,) foliage.
Insect, *Lachnosterna micans*, (68,) foliage.
Insect, *Lachnosterna hirticula*, (69,) foliage.
Insect, *Holotrichia crenulata*, (70,) foliage.
Insect, *Trichestes tristis*, (71,) foliage.
Insect, *Polyphylla variolosa*, (72,) foliage.

POPLAR, (POPULUS:)

Insect, *Cotalpa lanigera*, (77,) foliage.

POTATO, (SOLANUM TUBEROSUM:)

Insect, *Meloe angusticollis*, (177,) foliage.
Insect, *Macrobasis* { *Fabricii*, *cinerea*. } (179,) foliage.
Insect, *Epicauta* { *Pennsylvanica*, *atrata*. } (180,) foliage.
Insect, *Epicauta vittata*, (182,) foliage.

PREDACEOUS, (preying upon other insects, and generally beneficial:)

Larva, insect, *Cicindelidæ*, (1.)
Larva, insect, *Cicindela vulgaris*, (1.)
Larva, insect, *Carabidæ*, partly, (3.)
Larva, insect, *Calosoma calidum*, (3.)
Larva, insect, *Calosoma scrutator*, (4.)
Insect, *Brachinus fumans*, (5.)
Insect, *Lebia grandis*, (6,) destroys larva, Doryphora.
Larva, insect, *Dytiscidæ*, partly, (11.)
Insect, *Gyrinidæ* (12.)
Insect, *Dineutes Americanus*, (12.)
Larva, *Hydrophilidæ*, (13,) insect feeds on vegetable matter.
Insect, *Lucanus*, *Europe*, (51,) caterpillars.
Larva, *Lampyridæ*, some, (125,) larva of borers.
Larva, *Ellichnia corruscus*, (125,) worms.
Insect, *Telephoridæ*, (130,) other insects.
Insect, *Telephorus bilineatus*, (130,) other insects.
Insect, *Malachidæ*, (131,) other insects.
Larva, *Cleridæ*, (132,) other insects.
Larva, { *Thanasimus formicarius*, *Clerus*. } Europe, (138,) bark beetles.
Larva, *Pseudoclerus nigripes*, (139,) Hylesinus aculeatus.
Insect, *Necrobia violaceus*, (144,) other insects.
Larva, *Pytho Americanus*, (189,) Rhagium lineatum.?

PUFF BALL. (See also FUNGI.)

Larva, *Cœnocara oculata*, (151.)

RASPBERRY. (See also BLACKBERRY.)

Insect, *Byturus tomentosus*, Europe, (46,) fruit.
Larva, *Byturus tomentosus* Europe, (46,) cuts footstalk of flower.
Larva, *Agrilus ruficollis*, (101,) pith of stem.
Insect, *Dasytes niger*, Europe, (118,) cuts off blossoms.

REEDS:

Insect, *Cyphon pallidus*, Europe, (121,) winters in stems.

RHUBARB, (RHEUM:)

Larva, *Sitodrepa panicea*, (152,) in dried root.

RICE, (ORYZA:)

Larva, *Murmidius ovalis*, Europe, (28,) grain.

ROOTS. (See also HERBACEOUS AND GRASS ROOTS.)

Larva, *Macrodactylus subspinosus*, (65,) herbaceous, &c.
Larva, *Lachnosterna fusca*, &c., (67,) herbaceous, &c.

ROOTS. (See also HERBACEOUS AND GRASS ROOTS.)

Larva, *Cotalpa lanigera*, (77.) herbaceous, &c.
Larva, *Euryomia inda*, (84.) herbaceous, &c.
Larva, *Elater obscurus*, Europe, (110.) herbaceous, &c.
Larva, *Agriotes manchus*, &c., (112.) herbaceous, &c.

ROSE, (ROSA:)

Insect, *Serica sericea*, (63.) foliage, flowers.
Insect, { *Camptorhina*, / *Serica*, } *vespertina*, (62.) foliage, flowers.
Insect, *Macrodactylus subspinosus*, (65,) foliage, flowers.

RYE:

Larva, Insect, *Zabrus gibbus*, Europe, (8.) roots, grain.

SAP OF TREES, ETC:

Insect, *Lucanidæ*, (51.)
Insect, *Cetoniini*, (81.)
Insect, *Cotinus nitida*, (82.)
Insect, *Erirhipis inda*, (84.)

SKINS. (See also COLLECTIONS OF NATURAL HISTORY, ETC.)

Larva, *Dermestidæ*, (45.)
Larva, *Dermestes vulpinus*, (48.)
Larva, *Anthrenus varius*, (50.)

SNAILS:

Larva, Insect, *Silpha lævigata*, Europe, (16.)
Larva, Insect, *Silphidæ*, Europe, (16.)
Larva, Insect, *Lampyris noctiluca*, Europe, (126.)

SNAKES, DEAD. (See also CARRION.)

Insect, *Necrophorus americanus*, (18.)

SPIRÆA:

Insect, *Anthrenus varius*, (50,) on flowers.

SPAWN. (See FISH SPAWN.)

SPRUCE, (ABIES:)

Larva, *Ancylochira striata*, (95,) wood.

SUGAR:

Insect, *Sylvanus surinamensis*, (39,) found in.
Insect, *Nausibius dentatus*, (42,) found in.
Larva, { *Pyrophorus noctilucus*, S. America, / *Elater* W. I? } (109,) roots of canes.

SUMACH, (RHUS:)

Insect, *Anomala varians*, (73,) foliage.

SWEET BRIER,

Insect, { *Camptorhina vespertina*, / *Serica*, } (62,) foliage.
Insect, *Serica sericea*, (63,) foliage.

TEA,

Insect, *Sylvanus surinamensis*, (39.) floating on.

TOBACCO,

Insect, *Sylvanus surinamensis*, (39.) eating holes in dried leaf.

UMBELLIFERÆ. (See also FLOWERS.)

Insect: *Anthrenus varius*, (50.) flowers.

VEGETABLES. (See CABBAGE, ETC.)

VEGETABLE SUBSTANCES DECAYING OR DECOMPOSING:

Insect, *Hydrophilidæ*, some, (13.) (larvæ predaceous.)
Insect, { *Staphylinidæ*, / *Staphylinini*. } partly, (25.) found in.
Insect, *Histeridæ*, partly, (27.) found in.
Insects, *Nitidulidæ*, (29,) found in.
Larva, Insect, *Stelidota geminata*, (33,) found in.
Insect, *Cryptophagidæ*. (44.) found in.
Larva, *Melolonthidæ*, (59,) in vegetable substances.
Insect, *Tenebrionidæ*, partly, (158,) found in.

VEGETABLE ROOTS. (See also HERBACEOUS ROOTS.)

Larva, *Elateridæ*, (110,) feeds on roots.
Larva, *Elater obscurus*, Europe, (110,) feeds on.
Larva, *Melanotus communis*, (114.) feeds on roots.
Larva, *Agriotes segetis*, (113,) Europe, feeds on roots.

WALNUT, (JUGLANS:)

Larva, *Synoxylon basilare*, (155,) wood.

WASPS, (VESPA:)

Larva, *Clerus*, Europe, (135,) destroys larva.
Larva, *Rhipiphorus paradoxus*, Europe, (175,) in nests.
Larva, *Stylopidæ*, (176,) Europe, in body.
Larva, *Meloidæ*, (177.) Europe, attached to body.

WATER PLANTS:

Insect, *Hydrophilus piceus*, (13.) foliage.

WHEAT, (TRITICUM VULGARE:)

Larva, *Calathus latus*, Europe, (7,) injures grain.
Larva, *Zabrus gibbus*, (8,) injures grain.
Larva, *Amara*, (9,) injures grain.
Insect, *Harpalus caliginosus*, (10,) injures grain.
Larva, *Staphylinus?* Europe (25,) injures plants.
Larva, *Trogosita dubia*, &c., (36,) grain.
Larva, *Sylvanus surinamensis*, (39,) grain.
Larva, *Sitodrepa panicea*, (152,) grain.
Insect, *Rhizopertha pusilla*, (157,) grain.
Larva, *Tenebrionidæ*, partly, (159,) grain.

WHORTLEBERRY, (VACCINIUM:)

Insect, *Serica tricolor*, (64,) frequents bushes.

WILLOW, (SALIX,) OSIER, ETC :) &c.

Larva, *Lucanus dama*, (51,) wood.
Larva, { *Cotalpa lanigera*, / *Areoda*. } (77,) foliage.
Larva, *Dynastes tityrus*, (80,) decaying wood.

WOOD IN GENERAL. (See also APPLE, OAK, ETC.,) &c.

Larva, *Dynastidæ*, some, (80,) decaying wood.
Larva, *Pelidnota punctata*, (76,) decaying wood.
Larva, *Elateridæ*, (106,) some, decaying wood.
Larva, *Melanotus communis*, (114,) decaying wood.
Larva, *Lycus*, (122,) found in decaying wood.
Insect, *Orthopleura damicornis*, (142,) found in decaying wood.
Larva, *Ptinidæ*, (149,) found in decaying wood.
Insect, *Cupes cinerea*, (148,) common about old frame-houses.
Larva, *Ptilinus pectinicornis*, Europe, (153,) wood.

WOOLEN CLOTH:

Larva, *Ptinus fur*, Europe, (150.)

WORMS, EARTH WORMS:

Larva, { *Ellipolampis pyralis*, / *Photinus*, } (126.)
Larva, *Telephorus*, Europe, (130.)

TOWNEND GLOVER.

REPORT OF SUPERINTENDENT OF GARDEN AND GROUNDS.

SIR: Numerous packages of seeds and plants are yearly placed in my hands for trial in the garden. These are sent to the Department in good faith, with a view to the introduction and dissemination of valuable and useful plants: but the majority of these donations proves either to be well known species, or those of but little special value: and very frequently the plants are shrivelled and dead when unpacked, and the seeds fail to vegetate.

UTAH CURRANTS.

Both seeds and plants of these currants have been repeatedly sent to the Department during the past six years. They appear to be varieties of *Ribes aureum*, and, although the fruit of several of them is large, of fine appearance, and of a variety of colors, from light yellow to black, yet it has large seeds and but little pulp, and will not probably be cultivated where the improved varieties of the red currant, *Ribes rubrum*, can be procured. It is said that fine jellies have been prepared from these fruits, forming a good substitute for that produced from the red and the white currant of the gardens. Many of these Utah sorts produce as large fruit as the Cherry currant, but of no distinctive flavor.

DARIO GRAPE.

Under this name seeds of a grape were received, in 1863, from the United States consul at Damascus, said to have been collected from the peasantry of the village of Dario. They were highly recommended. The seeds vegetated freely, but the plants have proved to be unsuited for open air culture in this climate. In order to prove the quality of the fruit, plants were placed in a glass structure, where they produced a small grape of no particular merit: quite inferior to good varieties of the foreign grape.

ROCKY MOUNTAIN CHERRY.

This cherry was described in the report of the Department for 1866, where it was claimed to possess desirable qualities as a fruit. Plants received by the department have fruited during the past season, proving to be identical with the sand cherry. The fruit has no particular merit, the plant being a slender growing bush, botanically interesting, but not otherwise valuable.

GRAPES FROM AUSTRALIA.

In the spring of 1868, a package of grape cuttings was received from Melbourne. They were cut into pieces about two feet in length, and packed in a tight case so as to be completely enveloped in charcoal dust. Notwithstanding the length of time that elapsed during their passage,

and the various casualties of climate and transshipments, they were in perfect condition when opened, fresh and succulent, propagating freely from single eyes. These, although received under various local names, proved to be known varieties of the foreign grape, *Vitis vinifera*. Samples were fruited under glass; those in the open air have lingered on with more or less vigor, a few dying out yearly; the past season finishing the last of them.

The same result has been experienced with a collection of the so-called Hungarian grapes, which were received and planted several years ago. Some of the plants fruited, bearing good-sized and well-flavored fruit, which, however, failed to mature, on account of diseased foliage, and consequent checked growth. The last remnants of this collection have also disappeared.

NATIVE GRAPES.

The Concord, Hartford Prolific, Ives, Perkins, Clinton, and Dracut Amber have proved to be the only varieties perfectly exempt from disease during the past year. The Adirondack, Iona, Delaware, Rebecca, Diana, and others of very superior flavored fruit, when compared with the preceding list of healthy varieties, will decidedly take preference in localities congenial to their growth; but their liability to disease should always be taken into consideration, when extensive planting is contemplated. The conditions securing success, although known, cannot always be made available, and in planting in new localities, experiment can best decide upon the most suitable varieties.

The Diana Hamburg proves to be one of those grapes the liability of which to disease renders their profitable culture extremely local. In this respect the variety named is no exception to other hybrids between the native and the exotic grapes, especially when they partake largely of the qualities of the latter.

Several hybrids received from Mr. Arnold, of Paris, Canada West, by whom they were originated, are not yet of sufficient strength to fruit; their growth, so far, is satisfactory.

The Fedora grape, received from Mr. Cruickshanks, of Chelsea, Massachusetts, is evidently of exotic origin; its growth, however, as is not unusual for a time with varieties of the foreign species, has been healthy and even luxuriant. It has not yet fruited.

The same remarks may be applied to the Weehawken grape, donated by Dr. Siedhof, of Hoboken, New Jersey, who introduced the variety.

HYBRIDS OF THE SCUPPERNONG.

Dr. A. P. Wylie, of Chester, South Carolina, who has been studiously endeavoring to improve the Scuppernong grape, has favored the Department with some of his productions. In a letter accompanying them, he remarks that he has established the following facts in regard to hybridizing the Scuppernong:

"1st. The Scuppernong cannot be hybridized by any species of American grapes, and not even by its own hybrids with foreign varieties. 2d. The foreign species *(Vitis vinifera)* can be hybridized by Scuppernong. 3d. All native species and varieties, as well as foreign species, can be hybridized by hybrid Scuppernong; and, if any useful hybrid Scuppernongs are ever produced, it will be from operations in this direction."

These plants undoubtedly present external evidences of hybridization; the peculiar, slender foliage and wood of the Scuppernong are plainly

discernible. In my last report I alluded to the "belt of no frost" regions on the slopes of the southern mountain ranges, more particularly to the spurs of the Blue Ridge, in North Carolina, as noteworthy grape-growing localities. This important subject was first brought prominently into notice by Mr. Silas McDowell, of Franklin, Macon County, North Carolina. In a recent letter from this gentleman he remarks that further observations have enabled him to state that, "the frost line is not permanently fixed at any particular height on a mountain, but takes a higher or lower range according to the degree of frost that produces it; within the space of eleven years its maximum height has been three hundred feet, and its minimum height one hundred and twenty-five feet, vertical. The maximum is attained when the thermometer falls to twenty-four degrees, and the minimum when the thermometer shows thirty-one degrees. Another fact ascertained is, that there is no fixed dew-line on our mountain sides, but that it gradually abates as you ascend, and at the height of three hundred feet the dew is too light to produce either a grape-rot or leaf-blight. Hence we understand why the *thermal zone* is both warm and dry—the true cause why grapes growing in that region never fail to ripen their fruit in perfection. I will not venture to say that the grape will never rot within the limits of that zone, because an exceedingly wet summer might produce that result; but this I can say: The Isabella is decidedly the most unreliable grape that we have, when planted in our low valleys; but, where the vines are growing on the slopes of the mountains, they have not failed to ripen their fruit for more than thirty years, whether the season was wet or dry. In relation to a climate and soil most congenial to the grape, within the field of my observations, I would name that portion of the Alleghany range of mountains which runs through western North Carolina and northern Georgia, named here Blue Ridge. The main direction of this range is from northeast to southwest at its most southern bend, reaching the thirty-fifth degree of north latitude; and the crests have an average height of about three thousand feet, perpendicular, above the level of tide-water. The waters that flow from them on the northwest side run into the Mississippi, and those of the southeast directly into the Atlantic. The country on the Atlantic side sinks rapidly by a succession of long sunny slopes, reaching down into the plain or level country. It is on these slopes that the atmosphere is pure and dry, a refuge for the consumptive, as diseases of the lungs have never yet been known to originate among the inhabitants of these dry, fogless mountains; and here also will the grape find its most salubrious climate and genial home; and, if ever a 'Johannisberger,' a 'Medoc,' or a 'Margeaux' is found on this side of the Atlantic, in my opinion it will be here."

PEARS.

The frequent loss of bearing trees by blight is a fruitful source of vexation and loss in many localities. It is now fully established that the active agent in this disease is fungoid growths.

It cannot be doubted that healthy vegetation may be attacked by these minute organisms of destruction; but it is still questionable whether they will originate on a perfectly healthy plant. It seems more generally true that diseased or unhealthy individuals contract this form of rapid decay, from which it is communicated to others. We know, for instance, that decayed potatoes and apples will communicate their conditions to healthy specimens when placed in contact with them.

Among the many reasons that have been suggested as a cause of

blight in the pear tree, that of unripened wood has not been the least frequent; and the fact that many independent observers have arrived at the same conclusion seems to point it out as a probable cause.

It cannot have escaped the notice of persons who have had a general collection of pear trees under their care and observation for a series of years, that those plants which have, by whatever means, been induced to grow freely until late in the season, and have been overtaken by frosts while their growth was soft and succulent, have been the first to show symptoms of disease. There are many noted instances on record showing that pear orchards, while kept under a continued system of disturbing cultivation, surface stirring during the summer, manuring and ploughing during the winter and spring; have been severely thinned by blighted limbs and dead trees, but which have been rendered both fruitful and healthy, and all diseases checked, by simply abandoning all such cultural expedients, and employing the scythe as the only implement in keeping weeds and undergrowths in check. It is not at all uncommon to meet with comments depreciatory of this "negligent treatment," as it is termed. We must not, however, be too strongly influenced by mere terms, or words, especially when they are misapplied. All appliances and operations that are distinguished by the term culture should have for their object the increase and healthy development of the products to which they are directed. Cultivation, in this instance, is a term indicative of those operations necessary to maintain a healthy equilibrium of the elements of plant growth. It therefore ceases to be a proper term when describing operations the effects of which are clearly to induce disease in plants, by encouraging extension of growth at improper periods. If the health or the productiveness of an orchard depends upon the absence of all disturbance of the soil over the roots of the trees, further than may be necessary to prevent extended spread of weeds or undergrowths by occasionally mowing, it seems difficult to understand why such treatment should be denounced as improper, and designated as "neglected culture." Still, it is quite as reasonable to use that phrase, under the circumstances, as it is to characterize a course of treatment that stimulates plants to their destruction, by the high-sounding term of "scientific cultivation."

Among other operations tending to the production of unripened growths, late summer pruning may be mentioned as one of the most injurious. Although the practice is not so prevalent as it was ten years ago, it is far from being obsolete; but as cultivators shape their practice more and more from the knowledge acquired by study of cause and effect, rather than from one-sided theories, (an error we are all prone to adopt,) summer "shortening in," as it is technically termed, will have few advocates, and still fewer practitioners.

It is now many years since the writer, somewhat timidly, recommended root pruning as an auxiliary to fruitfulness, and as a corrective of evils resulting from plethoric growth in trees. This ancient operation is an innovation upon the rules at present established, and will be performed only by those who are not trammeled by popular opinion, when opposed to convictions formed from careful observations and practical study of vegetable economy—a class of cultivators rapidly increasing in numbers and influence.

It may be well questioned whether the system of "shortening in," now so generally performed on fruit trees at the winter pruning, is not more injurious than beneficial in most cases. In establishing the base or foundation for a spreading form in young trees, a shortening back of the youngest shoots will be unavoidable, but that a continuation of such

treatment is necessary is known to be a fallacy. The continued encouragement thus given to a multiplication of young shoots prevents the formation of fruit-producing branches; the trees become dense with slender growths, requiring constant thinning and manipulation to preserve even the appearance of a fruit-bearing tree. Seeing that the objects desired are so widely different, it must be apparent that the treatment best adapted to form plants into a close, thick-set hedge cannot be a proper mode of managing those cultivated solely for their fruits.

It is probable that the best mode of managing pear trees is to refrain, as far as possible, from shortening back the leading points of branches, thus giving them an opportunity of producing fruiting spurs over the entire surface of the yearly growths, which they will speedily do if not disturbed by the pruning knife; and when they become destitute of such spurs near the base or main trunk of the tree, as in time they most certainly will, and it is desired to keep the plants low or dwarf in habit, these long, spurless branches can be thinned out by removing them entirely, cutting them quite close to the trunk, supplying their place with young shoots, somewhat similar to the mode adopted in the so-called "renewal system" of pruning the grape-vine. Whatever mode may be adopted, it is perfectly evident that many of the failures in pear culture are clearly traceable to erroneous practices and false ideas of culture.

ARBORETUM.

Much time and attention have been given to the improvement of the grounds of the Department. The flower garden in the main front of the building is completed, with the exception of the architectural terraces. The principal avenues and walks are rapidly approaching completion. Draining has been effected as far as means will allow: much, however, of this fundamental work remains to be done, as the ground is largely underlaid with a retentive subsoil. For purposes of protection and shelter, an Osage-orange hedge has been planted around the boundaries of the inclosure.

About three-fourths of the list of plants have been secured, and preparations for planting are now in progress, so that, when the proper season arrives, no delay may occur in placing each plant in its assigned position. The space allotted to each plant is computed so as to allow full development of growth for a period of forty years, so far as data have been available in deciding upon the respective dimensions each will assume. Alterations as indicated by progressive development can, to a great extent, be effected for many years to come, without interfering with the main design, and, in view of the novelty of the arrangement, such modifications may become necessary; but it is believed that there will be but few changes to make in the present position of the plants.

A list of the plants and also the classification adopted are subjoined. In some of the orders slight additions will be made to the present numbers; but as the collection stands, it forms probably as complete an arboretum as is to be found in any country.

DICOTYLEDONÆ.—ANGIOSPERMÆ.

DIVISION I.—POLYPETALÆ.

MAGNOLIACEÆ.—Magnolia, 10 species, 9 varieties; Schizandra, 1 species; Kadsura, 1 species; Liriodendron, 1 species, 3 varieties.
ANONACEÆ.—Asimena, 2 species.
LARDIZABALACEÆ.—Akebia, 1 species; Stauntonia, 1 species.

MENISPERMACEÆ.—Cocculus, 1 species; Menispermum, 1 species; Calycocarpum, 1 species.

BERBERIDACEÆ.—Berberis, 20 species, 10 varieties; Mahonia, 10 species.

HYPERICACEÆ.—Hypericum, 6 species; Androsaemum, 1 species.

TAMARISCINEÆ.—Tamarix, 6 species.

MALVACEÆ.—Hibiscus, 1 species, 10 varieties.

STERCULIACEÆ.—Sterculia, 1 species.

TILIACEÆ.—Tilia, 2 species, 20 varieties.

CAMELLIACEÆ.—Stuartia, 2 species; Gordonia, 1 species

MELIACEÆ.—Melia, 2 species.

RUTACEÆ.—Zanthoxylum, 2 species; Ptelea, 2 species, 1 variety

SIMARUBACEÆ.—Ailanthus, 1 species.

CORIARIEÆ.—Coriaria, 3 species.

ANACARDIACEÆ.—Rhus, 7 species; Pistacia, 2 species.

RHAMNACEÆ.—Rhamnus, 11 species, 4 varieties; Frangula, 2 species; Sageretia, 1 species; Berchemia, 1 species; Zizyphus, 1 species; Ceanothus, 13 species; Paliurus, 1 species.

CELASTRACEÆ.—Euonymus, 9 species, 11 varieties; Celastrus, 1 species.

SAPINDACEÆ.—I, *Staphyleaceæ:* Staphylea, 3 species. II, *Sapindaceæ veræ:* Æsculus, 11 species, 12 varieties; Kolreuteria, 1 species. III, *Acerineæ:* Acer, 27 species, 17 varieties; Negundo, 1 species, 4 varieties.

LEGUMINOSÆ.—Sub-order I, *Papilionaceæ.* Tribe I, Loteæ: Genista, 13 species, 1 variety; Ulex, 3 species, 1 variety; Spartium, 1 species, 1 variety; Laburnum, 2 species, 11 varieties; Cytisus, 16 species; Sarothamnus, 1 species, 1 variety; Ononis, 2 species; Amorpha, 5 species, 1 variety; Colutea, 2 species; Robinia, 3 species, 25 varieties; Caragana, 11 species; Halimodendron, 1 species; Wistaria, 3 species, 2 varieties. Tribe II, Hedysareæ: Coronilla, 1 species. Tribe V, Sophoreæ: Sophora, 1 species, 2 varieties; Cladrastis, 1 species.—Sub-order II, *Cæsalpinieæ.* Cercis, 2 species, 2 varieties; Gymnocladus, 1 species; Gleditschia, 6 species, 5 varieties.—Sub-order III, *Mimoseæ.* Albizzia, 1 species.

ROSACEÆ.—Sub-order I, *Amygdaleæ.* Amygdalus, 3 species, 16 varieties; Amygdalopis, 1 species; Prunus, 27 species, 12 varieties.—Sub-order II, *Rosaceæ veræ.* Tribe I, Spiræeæ: Kerria, 2 species, 2 varieties; Spiræa, 41 species, 6 varieties; Schizonotus, 2 species, 1 variety. Tribe II, Dryadeæ: Potentilla, 2 species, 2 varieties; Rubus, 8 species, 5 varieties.—Sub-order III, *Pomeæ.* Cratægus, 36 species, 27 varieties; Photinia, 2 species; Cotoneaster, 18 species; Amelanchier, 5 species, 5 varieties; Mespilus, 2 species; Pyrus, 33 species, 40 varieties; Cydonia, 2 species, 12 varieties.

CALYCANTHACEÆ.—Calycanthus, 6 species; Chimonanthus, 1 species, 2 varieties.

LYTHRACEÆ.—Punica, 2 species; Lagerstrœmia, 5 species.

SAXIFRAGACEÆ.—Sub-order I, *Grossulæ.* Ribes, 24 species, 7 varieties.—Sub-order II, *Escallonieæ.* Itea, 1 species.—Sub-order III, *Hydrangieæ.* Hydrangea, 5 species; Decumaria, 1 species; Philadelphus, 9 species, 7 varieties; Deutzia, 6 species, 2 varieties.

HAMAMELACEÆ.—Tribe I, Hamameleæ: Hamamelis, 1 species. Tribe II, Fothergilleæ: Fothergilla, 1 species. Tribe III, Balsamifluæ: Liquidamber, 2 species.

UMBELLIFERÆ.—Bupleurum, 1 species.

ARALIACEÆ.—Aralia, 3 species; Hedera, 3 species, 4 varieties.

CORNACEÆ.—Cornus, 12 species 4 varieties; Benthamia, 1 species; Nyssa, 3 species; Garrya, 1 species.

DIVISION II.—MONOPETALEÆ.

CAPRIFOLIACEÆ.—Tribe I, Lonicereæ: Linnæa, 1 species; Symphoricarpus, 5 species, 1 variety; Lonicera, 35 species, 11 varieties; Diervilla, 4 species, 13 varieties; Leycesteria, 2 species. Tribe II: Sambucus, 4 species, 9 varieties; Viburnum, 17 species, 6 varieties.

RUBIACEÆ.—Sub-order II, *Cinchoneæ.* Cephalanthus, 1 species.—Sub-order III, *Loganiæ.* Gelsemium, 1 species.

COMPOSITÆ.—Sub-order 1, *Tubulifloræ.* Baccharideæ: Baccharis, 3 species. Senecionideæ: Iva, 1 species; Artemisia, 3 species.

ERICACEÆ.—Sub-order I, *Vaccinieæ.* Gaylussacia, 5 species; Vaccinium, 16 species, 5 varieties; Chiogenes, 1 species.—Sub-order II, *Ericineæ.* Arctostaphylos, 2 species; Epigæa, 1 species; Arbutus, 4 species; Leucothœ, 5 species; Cassandra, 1 species; Cassiope, 2 species; Andromeda, 7 species; Oxydendrum, 1 species; Clethra, 2 species; Phyllodoce, 1 species; Pernettya, 2 species; Kalmia, 7 species, 2 varieties; Dabœcia, 1 species, 1 variety; Menziesia, 2 species, 2 varieties; Azalea, 4 species, 2 varieties; Rhododendron, 6 species; Rhodora, 1 species; Ledum, 2 species; Loiseleuria, 1 species; Leiophyllum, 1 species.

AQUIFOLIACEÆ.—Ilex, 25 species, 14 varieties; Myginda, 1 species; Nemopanthes, 1 species.
STYRACEÆ.—Styrax, 4 species; Halesia, 3 species; Symplocos, 1 species.
CYRILLACEÆ.—Cyrilla, 1 species; Elliottia, 1 species.
EBENACEÆ.—Diospyros, 2 species.
SAPOTACEÆ.—Bumelia, 4 species, 1 variety.
BIGNONIACEÆ.—Bignonia, 1 species; Tecoma, 2 species; Catalpa, 4 species.
SCROPHULARIACEÆ.—Paulownia, 1 species; Buddlea, 1 species.
VERBENACEÆ.—Callicarpa, 1 species; Vitex, 2 species, 1 variety.
ASCLEPIADACEÆ.—Periploca, 1 species.
JASMINACEÆ.—Jasminum, 9 species, 1 variety.
OLEACEÆ.—Tribe I, Oleineæ: Ligustrum, 12 species, 4 varieties; Olea, 1 species; Chionanthus, 1 species, 1 variety. Tribe II, Syringeæ: Syringa, 4 species, 34 varieties; Fontanesia, 1 species; Forsythia, 3 species. Tribe III, Fraxineæ: Fraxinus, 19 species, 16 varieties; Ornus, 2 species. Tribe IV, Forestiereæ: Forestiera, 2 species.

DIVISION III.—APETALÆ.

ARISTOLOCHIACEÆ.—Aristolochia, 2 species.
POLYGONACEÆ.—Brunnichia, 1 species.
LAURACEÆ.—Laurus, 1 species; Persea, 1 species, 1 variety; Sassafras, 1 species; Lin dera, 2 species; Tetranthera, 1 species.
THYMELEACEÆ.—Dirca, 1 species; Daphne, 7 species, 6 varieties.
ELÆAGNACEÆ.—Shepherdia, 2 species; Elæagnus, 5 species, 1 variety; Hippophæ, 2 species, 1 variety.
SANTALACEÆ.—Darbya, 1 species; Pyrularia, 1 species; Buckleya, 1 species.
EUPHORBIACEÆ.—Stillingia, 1 species; Buxus, 8 species, 9 varieties.
EMPETRACEÆ.—Empetrum, 1 species; Corema, 1 species; Ceratiola, 1 species.
URTICACEÆ.—Sub-order I, *Ulmaceæ*. Ulmus, 17 species, 37 varieties; Planera, 3 species; Celtis, 5 species, 2 varieties. Sub-order II, *Artocarpeæ*. Morus, 5 species, 4 varieties; Broussonetia, 1 species, 1 variety; Maclura, 2 species, 1 variety; Ficus, 1 species.
PLATANACEÆ.—Platanus, 3 species, 2 varieties.
JUGLANDACEÆ.—Juglans, 3 species, 3 varieties; Carya, 10 species, 1 variety; Pterocarya, 1 species.
CUPULIFERÆ.—Quercus, 39 species, 51 varieties; Castanea, 3 species, 12 varieties; Fagus, 3 species, 13 varieties; Corylus, 4 species, 2 varieties; Carpinus, 2 species, 4 varieties; Ostrya, 3 species.
MYRICACEÆ.—Myrica, 3 species, 2 varieties; Comptonia, 1 species.
BETULACEÆ.—Betula, 9 species, 6 varieties; Alnus, 7 species, 9 varieties
SALICACEÆ.—Salix, 121 species, 12 varieties; Populus, 12 species, 6 varieties.

GYMNOSPERMÆ.

CONIFERÆ.—Sub-order I, *Abietineæ*. Pinus Binæ, 25 species, 24 varieties; Pinus Ternatæ, 25 species, 3 varieties; Pinus Quinæ, 35 species, 5 varieties; Pinus Dubiæ, 5 species; Abies Veræ, 14 species, 23 varieties. Tsuga: Abies, 7 species, 6 varieties. Picea Bracteata: Abies, 10 species, 8 varieties. Picea Brevebracteata: Abies, 11 species, 5 varieties: Cedrus, 3 species, 6 varieties; Cunninghamia, 1 species, 1 variety; Sciadopitys, 1 species; Sequoia, 2 species; Larix, 9 species, 7 varieties; Pseudolarix, 1 species; Araucaria, 7 species, 5 varieties; Dammara, 8 species, 2 varieties.—Sub-order II, *Cupressineæ*. Juniperus (oxycedrus), 7 species, 7 varieties; Juniperus (Sabinæ), 9 species, 12 varieties; Juniperus (Cupressoides), 16 species, 2 varieties; Widdringtonia, 5 species; Callitris, 1 species; Libocedrus, 4 species; Actinostrobus, 1 species; Frenela, 19 species; Lacchhardtia, 1 species; Fitzroya, 1 species; Thuja, 3 species, 15 varieties; Thujopsis, 3 species, 2 varieties; Biota, 1 species, 15 varieties; Cupressus, 20 species, 15 varieties; Retinospora, 5 species, 7 varieties; Cryptomeria, 1 species, 4 varieties; Taxodium, 1 species, 4 varieties; Glyptostrobus, 2 species. Sub-order III, *Taxineæ*. Taxus, 7 species, 21 varieties; Torreya, 4 species; Cephalotaxus, 4 species; Podocarpus, 43 species, 3 varieties; Dacrydium, 6 species; Salisburia, 1 species, 3 varieties; Phyllocladus, 5 species; Microcachrys, 1 species; Pherosphæra, 1 species; Saxe-Gothea, 1 species; Nageia, 7 species, 1 variety; Veitchia, 1 species.

WM. SAUNDERS.

Hon. HORACE CAPRON, *Commissioner.*

REPORT OF SUPERINTENDENT OF SEED DIVISION.

SIR: The following tabular statement shows the quantity and kinds of seeds sent from this division during the year ending December 31, 1868:

To whom sent.	Vegetable garden seeds—25 varieties.	Flower garden seeds—72 varieties.	Seeds for field culture.					
			Turnips—24 varieties.	Potatoes—12 varieties.	Tobacco—4 varieties.	Sorghum—1 variety.	Oats.	Alsike clover.
	Papers.	*Papers.*	*Papers.*	*Quarts.*	*Papers.*	*Gills.*	*Q'ts.*	*Gills.*
Members of Congress	156, 815	31, 800	....	344	19, 495	2, 460	227	753
Agricultural societies	82, 598	750	....	192	759	....	384	....
Correspondents	76, 614	....	....	....	349	....	....	....
Miscellaneous	114, 484	58, 341	4, 876	262	3, 086	116	274	333
Total	430, 511	90, 871	4, 876	798	23, 689	2, 576	885	1, 086

To whom sent.	Seeds for field culture.				Winter wheat.			
	Ramie.	Osage Orange.	Opium Poppy.	Buckwheat—1 variety.	Tappahannock.	Talavera.	Rough chaff.	Polish.
	Papers.	*Pints*	*Papers.*	*Quarts.*	*Quarts.*	*Quarts.*	*Quarts.*	*Quarts.*
Members of Congress	4, 250	476	1, 900	1, 446	3, 264	1, 408	1, 536	1, 428
Agricultural societies	5, 335	....	750	....	5, 272	522	768	2, 520
Correspondents	....	....	....	....	6, 225	680	604	1, 256
Miscellaneous	913	147	2, 000	135	1, 778	674	426	393
Total	10, 498	623	4, 650	1, 581	16, 539	3, 284	3, 334	5, 597

The United States and territories embrace about twenty-four degrees of latitude and fifty-eight degrees of longitude, and, in consequence of difference of elevation, direction of winds, and contiguous oceans, wide isothermal differences of temperature are manifest even in the same latitude; but within the different latitudes of these extended limits are found great diversities of climate and soil, adapted to the growth of plants of every quarter of the globe. The distribution of seeds was made with reference to climatic and thermal peculiarities; but the adaptability of seeds to different soils can be satisfactorily ascertained only by the sure test of experiment, and it is, therefore, to be regretted that practical farmers do not, as requested, more generally report to the department the results of their experiments with seeds sent to them.

All important facts connected with the cultivation of untried seeds should be carefully noted, and promptly reported to the department.

The object of the department in procuring and distributing seeds is, to substitute superior varieties for those which have deteriorated or have become diseased, and to introduce the seeds of new plants, that the resources of our broad and fertile domain may be developed, and its agricultural wealth increased. To accomplish these ends the co-operation of the farmer is indispensable. His farm is a laboratory in which the efficacy of new varieties and the success of novel productions are alike tested. Without an intelligent report, showing the means used and the results reached, the department must remain in doubt in regard to the success and utility of its seed distributions, except as they may be indicated in the steadily increasing products of the land, and in the general improvement of its farming interests. Reports promptly and regularly sent in would enable the department to furnish to the country and to the world an array of facts of great practical interest and value, while this co-operation on the part of farmers would tend surely to the advancement of their own interests, and to the increase of national wealth.

SENECA DEAN.

Hon. HORACE CAPRON, *Commissioner.*

REPORT ON AGRICULTURAL EDUCATION IN EUROPE.

SIR: In compliance with your request that I should procure certain information bearing upon the art and science of agriculture, I have the honor to submit the following observations:

The first and leading fact that arrests the attention of an American observer of agricultural phenomena on visiting Europe is, that in many European countries the annual yield per acre of all the land under cultivation is greatly on the increase from year to year, while in the United States the yield per acre is on the decrease. The question naturally arises: Is this gradual deterioration of American soil proof that Americans are poor farmers, or that our soil is naturally poor? Our soil is the best in the world, and practically we are the most skillful in nearly all the mechanical appliances required in farming. But the question still arises, Are we good farmers? It certainly was not good farming that permitted the soil of New England, New York, Pennsylvania, and Ohio to deteriorate from a yield of thirty bushels of wheat per acre (and other crops in proportion) to less than fifteen bushels; it was not good farming that permitted large portions of the southern States to become absolutely barren; and it is not good farming that is now permitting the unparalleled soil of our prairie States to grow less and less productive from year to year.

These facts suggest painful reflections, and indicate that our great skill in producing and adapting machinery to agricultural purposes, and our unsurpassed practical talent as a nation, are being employed only to exhaust the natural wealth of the country.

It was estimated, twenty years ago, that to restore the land then under cultivation in the United States to its original fertility, would cost a thousand millions of dollars. The same wasteful and exhaustive process is to a great extent still continued.

Have we, who happen to have possessed the land in its virgin wealth, any moral right thus to contract a national debt, the burden of which will oppress our children and our children's children? It is a delusion to suppose that this crime is greatly mitigated by the fact that our country possesses vast tracts of unoccupied land, to which we can remove as soon as we have partly exhausted our farms. Even if there were no limit to this, yet the argument would be founded upon false principles of political economy. There is a limit, however; and he who rightly estimates the natural increase of our population, augmented by the mighty tide of immigration, must see that all our public domain will soon pass into private hands.

Of an average of five hundred to six hundred per day of emigrants who leave the British isles, most of them go to America. Of three hundred thousand emigrants yearly from Germany, a great majority go to America. Also, many other countries, where the population has outgrown the land, are pouring a constant stream of emigration into our country in search of land to till. Is it not high time, then, that we arrive at some system of agriculture which will secure to us, as individuals and as a nation, the benefits of the progress that has been made in

countries where, from various causes, more attention has been paid to the cultivation of the soil?

England and Scotland are perhaps justly cited as leading all other nations in the art of agriculture. An over-crowded population and a very limited supply of land have made it necessary to adopt the best practices in the cultivation of the soil. The fact that nearly all the land is tilled by tenant farmers, at high rental, prohibits a poor farmer from holding the land, and, sooner or later, the most skillful farmers are put in possession. No matter from what causes the best practices in agriculture are secured, they are equally valuable as examples. Most tenants in England and Scotland are bound in the leases to some system of rotation of crops. That which is most common is called the "four-course system:" 1st, fallow or roots; 2d, wheat or barley; 3d, seeds; 4th, oats. The nature of the soil indicates the rotation. In cases where the tenant is known to be an intelligent and skillful farmer, the landlord often leaves him free to cultivate the land in his own way.

There are numerous examples of the application of scientific principles in farming in Great Britain that we might study with great advantage. The Marquis of Tweeddale, for instance, when he came into possession of his estate, found the land worth a rental of only ten shillings ($2 50) an acre. By calling to his aid the advice of scientific men, by his intelligence and enterprise, by the application of scientific principles and the most advanced practices to the treatment of the soils, he raised his entire estate to a degree of productiveness that commanded a yearly rental of £3 10s. ($17 50) per acre.

During the summer and autumn I visited numerous farms affording examples of intelligent and advanced culture: the Prince Consort farms, at Windsor; Lord Durham's estate, in Durham County; Sir Walter Trevelyan's estate, in Northumberland County; and others.

The course pursued by most American farmers is entirely without system. Good prices appearing to prevail for any given production will cause our farmers to push their crop in that direction, regardless of the injurious effects upon their farms, and indifferent to any general results. Thus all the fluctuations of markets operate to derange their modes of husbandry, and cause extra expense in all the machinery of the farm, including labor. A defined system of husbandry would enable our farmers to control the market instead of being at the mercy of its constant changes, and to greatly economize their expenditures, and at the same time keep up the quality of the soil. There is nothing more necessary in agricultural pursuits than some exact system, regulated by the discretion and intelligence of the farmer, guided by all the light that can be drawn from science and practice. We find in England and Scotland not only examples of ordinary farm management with careful study, but the art of feeding is unquestionably carried to a higher degree of perfection than in any other country.

I was greatly surprised, when I first attended a fair of the Royal Agricultural Society, on seeing the fat cattle; but I have been still more astonished on learning the very short time it required to fatten them for the butcher. This skill is dependent on many things, such as the selection of well-bred stock, the kind of food employed, and the mode of preparing it, and particularly the kind of food given to the stock when young, and many other things, all of which we should investigate.

My aim at present is, however, to examine such points as relate more directly to technical, or what is often termed practical, education for the farmer, or, more definitely, what relates to school or college education. On this point I am compelled to say that Great Britain does not

afford the highest examples, either in the efforts to connect agricultural education with the universities, or to establish separate agricultural colleges and academies. The reasons for this are obvious: Most of the land being cultivated by tenant farmers, they would naturally not favor any scheme for education that would equally benefit the farming community at large, and tend to increase the productions of the land generally, thereby most likely increasing the rental they must pay. But show the individual farmer how he can increase the productions of his own farm, and thereby produce better crops than his neighbor, and he is ready enough to accept your suggestion. Agricultural education in Great Britain is based upon a purely commercial theory. The young man is sent to some advanced farmer, in a good agricultural district, to remain one, two, or three years. Thus he becomes a good farmer, but knows little else. We aim at something higher than this in the United States, and hope to make the young farmer a student, skilled in his profession by acquiring a knowledge of the sciences on which the art of agriculture is based. For this purpose we must have schools and colleges. Agriculture is at length recognized as a science, and the time has gone by when our journals call in vain for government and State aid in its advancement, and when intelligent farmers plead in vain for assistance in the establishment of agricultural schools. The ground-work of our national wealth and power is now appreciated, and a generosity that is truly munificent pervades the government and people.

If, however, in the full flush of our hopes on this subject, we form a wrong conception of what we can accomplish, or if we adopt difficult or impossible measures to secure what we may legitimately aim at, the funds at our command may be squandered, and the generosity of the government, States, and individuals be discouraged. We have about fifty years of experience from which to draw lessons on the subject of agricultural schools. Failure has been a marked feature in the history of this enterprise. Let us note the bad practices which have led to partial or entire failures, and, abandoning them, study the elements of success, when success has been achieved.

In a former communication I claimed that the model-farm system should be given up as a part of the machinery of agricultural schools; I wish merely to add here that I consider model farms detrimental on account of the burden they impose, in various ways, upon the institution, even in cases like that of the Cornell University, where the endowments are so great that the institution may not feel the burden of the farm. No agricultural community will award the same faith or the same credit to the experiments of a college farm that they would to those of the separate, independent farmer. Farmers in general will feel a suspicion that the college farm is backed by college funds, and that results are secured under the influence of college bias. It is not the greatest possible results that the farmer looks for alone, but the highest productiveness of his soil that can be secured at the least cost. Of course the experimental ground is not included in the term model farm. Experimental grounds—which need not be very large—are indispensable.

One of the most important questions that our country is just now called upon to settle, is in relation to the value of separate agricultural schools, as compared with attaching them to universities, or making the agricultural school a department in a university. If the agricultural department is to be tacked on as a mere subordinate part, and is to be overshadowed by some other interest, I should decide in favor of separate schools, with all their disadvantages. It has too often happened that the effort to give agriculture a place in universities has

resulted in very little more than a mere name; yet I am of the opinion that the science and art of agriculture will best be raised to their true dignity by securing the proper instruction in connection with our universities. If universities, already established, will not give this subject a place proportionate to its importance, the act making the government grant of land for agricultural and mechanical education is so framed as to give us a most fortunate advantage in founding new institutions.

All that has been gained, thus far, on the side of practical education in the contest between the advocates of the old classical system and the advocates of the real studies, or the study of Nature, has been gained in connection with our colleges and universities. It is not long since any young man who wished to attain a standing as a scholar had but one course open to him. The study of Greek and Latin was forced upon him, no matter what his inclinations, tastes, or aptitudes might be. This rule, which required all to reach knowledge by the same road, has been measurably overthrown in our country. The study of the natural sciences, of Nature and her works, and of the laws that govern the physical universe, is raised to equal dignity with the study of what is styled a classical course. I would not disparage the study of Greek and Latin, but would greatly increase the amount of study now required. Greek and Latin literature opens to the human intellect the grandest fields of its own activities and resources; but, with the whole circle of human knowledge before us, we should give freedom of choice, and, to this end, insist upon more thorough preparation before any of the special courses be entered upon, during which time all should be educated alike; but when the choice can be made under the guidance of capacity or aptitude, the university course should be such as will accommodate all.

If the farmer or mechanic must go to an institution apart from students fitting themselves for other callings, his education will always be looked upon as a sort of half education, or at least as being of an inferior grade. Give these students a position of honor equal to any others, and, for an equal amount of good study in any chosen course, award the same credit. Contact of mind with mind plays a decided part in education. The contact of students of all callings creates new power, and spurs forward to higher ambitions. This influence or atmosphere of study is measurably lost by separate schools. Then, by associating the literary, and scientific, and the practical students, there is less danger of a social stamp being put upon the one differing from that put upon another. This is of great importance. In the university, too, any student may consult his taste or interest by acquiring a knowledge of studies allied to his chosen course, although not strictly belonging to it.

Economy is greatly on the side of the university plan. The machinery required is to a great extent the same for all the courses, and to multiply it, so as to supply as many separate schools as there are natural subdivisions in the university, would be a great waste of capital. I do not mean to argue that we may not at some time need special schools; but this is not our first great want.

In Prussia, where agricultural education has long been an established part of the school system, there are a number of old and well-established separate agricultural academies and schools. The university at Halle established an agricultural department in 1863, which now has one hundred and eighty students—more than double the number in attendance at any other agricultural school or academy in Prussia. I believe it will be found that where agricultural studies have proper care bestowed upon them in the universities, the latter will take the lead in this department.

It is an almost unavoidable result in cases of schools for any given purpose, that the studies are attempted to be rendered easy, with the view of adapting them to the special course. This is an injury to the student, and justly merits the position usually assigned such schools as being of a low grade. I find, both in England and on the continent, that those whose judgment is entitled to the greatest weight are inclining toward the opinion that agricultural education, so far as the schools are concerned, should be collegiate in character, or scientific. The same is true in regard to education in mechanics. The notion that the student should go to these schools to learn agriculture or any of the mechanical arts, very much as he would learn a trade, is rightfully discarded.

In the grand duchy of Baden I found the Ministerium of Trade and Agriculture engaged in the inauguration of a system of agricultural education which must succeed in extending the knowledge of the academies to the agricultural community. This system requires the establishment of a school in each district (eleven in the grand duchy) for the sons of farmers, (the peasantry,) the principal of each school to be paid by the government, and required to be not only an educated man, but educated in the science of agriculture. These schools are to consist of one term in the year (a winter term) of five months. The remainder of the year the principal teachers are to travel and study all the best practices of agriculture to be found in the country, occasionally lecturing in the villages to interest the farmers in the subject of the schools, that they may send their sons in the winter. This system not only extends to the people a knowledge of all that can be discovered in the academies and colleges, and by the best practice of the more intelligent and enterprising farmers, but it opens employment for thorough students of agriculture who go from the colleges from year to year.

There are only two institutions in Great Britain where agriculture is at present successfully taught—one in England and one in Scotland. The former is the Royal Agricultural College, at Cirencester, in Gloucestershire, which is devoted exclusively to agriculture; the latter is an agricultural department in the University of Edinburgh.

THE ROYAL AGRICULTURAL COLLEGE AT CIRENCESTER.

The Royal Agricultural College at Cirencester had for a long time but a feeble existence. The reasons were:

First. Want of capital, having no government aid, and charging its students at a non-paying rate.

Second. It was supporting a very heavy burden in the way of a model farm, which ran the institution in debt to the extent of about $50,000.

Third. It required the students to labor, and thereby secured satisfactory results neither in study nor in labor. All these difficulties have been overcome. The first, by increasing the charges for board and tuition, which of course changed the class of students; the second and third, by the abandonment of the practices out of which they grew. The institution is now self-sustaining and prosperous, and in September last, soon after the opening of the term, there were about seventy students in attendance. The increase of the expense of board and tuition excludes the sons of small farmers, who were at first intended to be educated at this institution, and the more wealthy classes now send their sons. If there were no question of expense, it would be impossible to mingle the two classes in the same institution in this country—a difficulty which, it is to be hoped, may never be encountered in America.

The Duke of Marlborough is president of the college, and its present faculty embraces the Rev. John Constable, principal, and six resident professors, occupying the chairs of agriculture, chemistry, natural history, anatomy, physiology and hygiene, mathematics and surveying, and drawing.

The institution was incorporated by charter, March 27, 1845. The college building is a handsome and commodious gothic structure, of stone, situated one and a half miles out of Cirencester. Its frontage is one hundred and ninety feet. The buildings include a chapel, dining-hall, library, museum, lecture-theater, laboratories, class-rooms, private studies, and servants' offices; with apartments for resident professors, and ranges of dormitories on the upper floors. The whole building is lighted with gas, and the best methods of warming and ventilation have been adopted. Each student has a separate sleeping apartment, and private studies are allotted to meritorious students.

The managers appear to appreciate the great educational value of a practical, industrial, and scientific museum; the college museum, possessing a valuable collection of geological specimens, minerals, and objects of natural history; an interesting set of anatomical and pathological preparations, such as casts of teeth, to illustrate the age of the horse, sheep, and other animals; an extensive museum of economic botany, containing specimen plants of many varieties of known cereals, samples of seeds of every species of plants used by the agriculturist, and a series of wax models of every variety of cultivated roots; and also a beautiful herbarium, containing about three thousand specimens of British plants.

Thirty acres of land are devoted to the purposes of an experimental farm, which is so managed that, by accurate records and the systematic weighing of animals and products, students are enabled to secure correct ideas of many of the important details of farm practice. The farm formerly conducted by the college as a model farm is now under the management of one of the graduates of the institution, to whom it is let with the reserved right of students and professors to visit it at will. This farm consists of about five hundred acres. The soil of the farms rests on the forest marble and great oolite. Much of it, therefore, is brash. The general elevation above the sea is about six hundred feet.

Instruction in agriculture is given by lectures and by daily practical exercises on the farms. The agricultural course of instruction thus embraces not only a scientific discussion of established methods of cultivating different kinds of soils in different climates; of the breeding, rearing, and general management of stock, and the use of machinery; but also affords a good illustration of the cultivation of at least one good farm in the neighborhood, to which, by an arrangement made with the tenant, the students have free access. Each student is expected to keep a daily journal of all the operations on the farm, and to make himself thoroughly acquainted with the accounts. Natural and mechanical philosophy are taught by a series of lectures delivered by the principal.

The chemical laboratory is well arranged and well furnished, and chemical manipulation and analysis are taught to each class of students in succession, under the superintendence of the professor of chemistry and his assistants. After studying the properties of the more commonly occurring substances, they are taught to analyze a series of compounds, proceeding from simple to more complex cases, and to apply the knowledge thus obtained to the analysis of manures, soils, ashes of plants, farm products, and other substances with which the practical agriculturist is more immediately concerned; and, in addition, there is a systematic

course of illustrated lectures given on inorganic, organic, and agricultural chemistry, as well as catechetical lectures. Analyses of artificial manures, oil cakes, waters, &c., are daily performed in the college laboratory, and chemico-agricultural researches undertaken by the more advanced students, under the immediate direction of Mr. Church and assistants.

Geology is taught by lectures, and practically illustrated in field excursions and geological surveys in the surrounding neighborhood.

The professor of botany delivers annually a full course of lectures in systematic botany, illustrated by a botanical garden belonging to the institution, which enables him to instruct practically in the botany of agriculture, and to show the students various experiments in vegetable physiology. The professor of botany conducts field classes weekly during the summer and autumn months.

Instruction in anatomy, physiology, and hygiene is given by lectures, illustrated by cases in the hospital attached to the college; and in order to make the teaching as practically useful as possible, students are required to record the particulars of all cases admitted for treatment, especially the results of post-mortem examinations.

In the department of mathematics and surveying the instruction is rendered as practical as possible by opportunities which are afforded for instruction in the field, in surveying, leveling, and land-measuring, and in the use of the theodolite, spirit-level, and other instruments. Architectural and mechanical drawing are also carefully taught in the institution. To such students as desire it, instruction in carpentry and smiths' work is given in the shops attached to the farm buildings.

There are two terms in the year, with vacations of seven weeks each, one vacation commencing about the 18th of June, and the other on the 18th of December. Students who complete the two years' course receive a diploma as graduates, under the title of members, on having passed a satisfactory examination in agriculture, chemistry, and any other one subject selected by the candidates.

Students who live in the institution (in-students) pay £100 per annum, to be paid half yearly, in advance. Students who live out of the institution (out-students) pay £50 per annum, half yearly, in advance.

There has recently been established at Cirencester a farmers' club, the lectures and discussions of which are of great service to the students of the college. Some of the professors belong to this club, and they find no difficulty in securing from among the leading farmers those who are willing to test practically the scientific discoveries or supposed improvements of the college, and to report results.

THE UNIVERSITY OF EDINBURGH.

The chair of agriculture in this university is at present endowed jointly by the Highland and Agricultural Society of Scotland and the government, and is filled by Professor John Wilson, an experienced and able scholar in the science of agriculture. The efficiency of this chair has recently been greatly increased.

The university has resolved to grant degrees to those who pass the prescribed examinations, in conformity with the educational curriculum prescribed by the Highland and Agricultural Society. It has been arranged that the lectures on agriculture shall extend over two sessions, in order that the subject may receive a more comprehensive consideration than has hitherto been accorded to it. The course has, therefore, been arranged in two divisions, and is completed in two sessions. The

first is occupied chiefly in discussing the principles: while in the second the practice of modern agriculture is more particularly considered. Each division of the subject is rendered as complete as possible, so as to meet also the requirements of those gentlemen who may not intend to go up for the diploma examination.

THE COURSE OF LECTURES.—*First Division.*—I. History of Agriculture, with the various epochs of advancement up to the present time: Sacred Writings, Ancient Egyptians, Greeks, Romans, Early and Middle Ages; Application of Science; Tull, Young, Sinclair, Davy, Liebig, Boussingault, &c.

II. General purposes of agriculture, conditions affecting it, and principles on which it is based; combination of knowledge necessary for their proper comprehension and successful application; the production of sufficient and regular supplies of food; civilization; increase of population; necessities for increased supplies; necessity for an acquaintance with the laws governing the three great kingdoms of nature, the animal, vegetable, and mineral, and the intimate union of all these. This combination of knowledge comprises—

III. The Chemistry of Agriculture: The constituents and chemical composition of soils, cultivated crops, the atmosphere, rain and spring water; chemical changes effected by decomposition and recombinations in reference to the gaseous and mineral food of plants; rotation of crops, fallowing and manuring—their principles discussed.

IV. The Geology of Agriculture: Conditions under which the different strata forming the earth's crust were deposited; their composition, mechanical and chemical, mode of disintegration, &c.; the formation of soils; the condition and extent of surface soils, and their characteristics and influence on agriculture; local variations; economic produce of different formations, as stones for building and other purposes, marbles, slates, clays, limestones, metallic ores, coals, salt, &c.; general surface geology of Great Britain.

V. The Botany of Agriculture: The nature and character of the various agricultural plants, and the diseases and insect ravages to which they are most liable, and their remedies; the weeds of agriculture; indigenous plants as indicative of quality of soils; special crops cultivated for food or for technical purposes, as linseed, coriander, woad, teazles, &c.; arboriculture, the cultivation and management of fruit and forest trees; planting, pruning, felling, barking, &c.

VI. The Physics of Agriculture: Meteorology, including climate and the various conditions affecting it; atmospheric effects, as winds, rain, hail, thunder-storms, their causes explained; barometer, thermometer, dew-point, &c., indications afforded by them; the absorption and retention of heat and moisture by different soils, and their capillarity in reference to drainage; hydrodynamics; the general laws of light, heat, and electricity as affecting the vegetable kingdom.

Second Division.—I. The Mechanics of Agriculture: their application in the practical operations of the farm. This will comprise the principles of construction of plows, harrows, scarifiers, rollers, horse-hoes, drills, threshing machines, reaping and mowing machines, chaff cutters, crushing and grinding machines; the application of steam to tillage purposes; motive power—man, horse, wind, water, steam—their absolute and relative values and various modes of application considered.

II. Rotations of various districts discussed and explained; sequence of agricultural operations; economical divisions of labor; the hay and corn crop; different modes of harvesting.

III. Improvement of the Soil by Draining, Manuring, &c.: Draining,

irrigation, warping, claying, marling, liming, paring, and burning: manures, farm-yard and artificial, solid and liquid, their chemical composition, suitability for different crops and modes of application, their comparative money values, adulterations, &c.

IV. Live Stock: Different breeds of cattle, horses, sheep, swine, poultry, &c.; the physiological principles of breeding, rearing, and feeding; special points to be attended to, their practical application in the treatment of stock generally; different substances used for feeding purposes, their composition, relative value, adulteration, &c.; the diseases and injuries to which farm stock are most liable.

V. The Economics of Agriculture: Dairy produce; butter and cheese making, baking, malting, brewing, wine and vinegar making; beet-root sugar and spirit; potato starch and spirit; flax, fiber, oil and cake; lime burning, brick and tile making, &c.

VI. Farm Engineering and Construction: Farm buildings; general principles to be observed, as position, aspect, size, materials, and mode of construction, cost, &c.; arrangement of land inclosures, fences, shelter, road making, draining, &c.

VII. Agricultural Policy: Tenancy—leases, size of farms, rent, capital, labor, wages; relation of landlord, tenant, and laborer; importance of correct farm accounts and general returns; agricultural statistics, markets, &c.

VIII. General Management and Improvement of Landed Property.

The students of agriculture in this university have the advantages of access to one of the best industrial museums in existence.

AGRICULTURAL SOCIETIES.

The Highland Agricultural Society of Scotland was incorporated by charter, May 17, 1787, by the name of the Highland Society of Scotland, and was newly incorporated June 18, 1834, by the name and style of the Highland and Agricultural Society of Scotland.

Much of the general improvement in the practice of agriculture in Scotland has been secured by the labors of this society in granting premiums for agricultual improvements; the holding of shows of cattle, implements, and produce, and for the general promotion of the science and practice of agriculture; and recently, since 1856, when it procured a supplementary charter conferring additional powers upon the society, by more efficient and direct efforts to promote agricultural education. The supplementary charter enabled the society to constitute and appoint a committee on education, to be called "The Council of the Highland and Agricultural Society of Scotland." This society is, therefore, now encouraging a high standard of agricultural education. The following is the course adopted by the council:

The council consider that, in organizing the proposed system of education, there are two leading points to be attended to: First. The offer of every proper encouragement and facility to induce and enable agricultural students to become candidates for the society's diploma. Second. The enforcement of stringent precautions against the possibility of the powers created by the charter being abused, or the diploma being conferred on insufficient grounds. The council conceive that a well-defined curriculum will serve as a guide to the young agriculturist, both as regards the subjects of study and the order in which they are to be pursued; and that its observance will afford the best guarantee for an education worthy of the diploma. This education must be of a two-fold character, scientific and practical—the one to be acquired in the class, the other on

the farm. The sufficiency of both should be tested; 1st, by evidence of attendance for prescribed periods in the class and on the farm; 2d, by rigid and searching examination after the required attendance has been completed.

In addition to a thorough acquaintance with the details of practical farming, a candidate must be conversant with those departments of the following branches of study which bear upon agriculture: 1, botany; 2, chemistry, scientific and applied; 3, natural history, including the principles of zoölogy and geology; 4, veterinary medicine and surgery; 5, field engineering and surveying; 6, the principles of mechanics and construction, as applied to the implements and buildings of the farm; 7, book-keeping and accounts.

While candidates are not tied down to any particular college or school, they must produce certificates of attendance for the prescribed period in the following classes in some educational institution, approved and recognized as sufficient by the examiners: Agriculture, botany, chemistry, natural history, veterinary medicine and surgery. Acquirements in field engineering and surveying, mechanics and construction, and book-keeping, may be established by examination, without certificate of attendance; but students should, nevertheless, take advantage of whatever classes may be available for these branches.

In following out the practical part of the course, students are not restricted to any particular part of the country or system of farming; but the examiners may judge of the sufficiency of the certificate produced, and of the competency of the party granting it. The whole course of study must embrace not less than four years—two at classes, and two at farm; and students should be strongly recommended to pass through the scientific departments first, so as to enter on the practical part with the advantages and the aids derivable from a proper education. When the scientific course is preferred in point of time, a student may be examined upon it before going to the farm.

A student may take alternate years of the classes and of the farm, but must not devote to either less than an entire year at a time. No part of the course must commence until the student is seventeen years of age, and a diploma cannot be granted until he is twenty-one.

THE SCIENTIFIC COURSE.—*First year.* Summer: botany, three months; book-keeping and accounts, three months. Winter: chemistry, six months; natural history, six months. *Second year.* Summer: analytical chemistry, three months; engineering and surveying, three months. Winter: agriculture, six months; veterinary surgery, six months.

This arrangement is merely suggested as providing a proper course of study and succession of subjects: but the student is not prohibited from adopting another order, provided he proves attendance for the prescribed period in the specified classes. By adopting the arrangement indicated, he has the advantage of carrying to the agricultural class a knowledge of botany, chemistry, and natural history; and he is examined immediately after the close of his course, and at the end of the winter session.

In addition to the professorship in the University of Edinburgh, the society has an able chemist, Thomas Anderson, M. D., of Glasgow.

ROYAL AGRICULTURAL SOCIETY.

The Royal Agricultural Society of England is, in addition to the ordinary work of agricultural societies, also making an effort to encourage agricultural education by granting certificates and awarding certain prizes; also by scientific and practical experiments conducted by one of

the most able agricultural chemists, Dr. Augustus Voelcker, consulting chemist of the society, and formerly chemist of the Royal Agricultural College at Cirencester.

PRIVATE WORKERS.

There is much valuable private work being done both in England and Scotland for the advancement of agriculture, which I cannot at present undertake to describe; and the scientific and practical experiments of J. B. Lawes, F. R. S., F. C. S., and Dr. J. H. Gilbert, F. R. S., F. C. S., at Rothamstead, are too well known to need a description.

I wish here only to call attention to the Rothamstead experimental station as being the best model I have yet seen for experimental farms for agricultural colleges. The thoroughness with which Dr. Gilbert executes his work, the perfect system with which he conducts his experiments and records the results, the size of the experimental plots of land, and the arrangement of the laboratory, are all most admirable.

The plots of land are often entirely too small (not more than three or four yards square) at experimental stations to insure reliable results, and frequently the results are rendered still less reliable on account of grass and weeds being permitted to grow; but at Rothamstead the plots are from one-eighth to a quarter of an acre in size, and kept perfectly clean.

The estate of Mr. Lawes, surrounding the experimental ground, is cultivated with a view to the greatest profit, by the application of principles developed at the experimental station, in the use of manures, rotation of crops, &c., and a complete record kept from year to year of the treatment and results. This station, though a private enterprise, has given to the world, in the way of scientific reports, papers, &c., results that have done and are doing much for the introduction of scientific principles in the practice of agriculture; and thus these gentlemen, though private workers, are among the leading educators of the people.

There are many intelligent farmers in England and Scotland who take young men who wish to learn agriculture practically, at £100 to £150 per year; but this is not educational in the sense in which we are considering the subject.

THE AGRICULTURAL INSTITUTIONS OF GERMANY.

At the present stage of progress in scientific agriculture in America, we cannot afford to neglect what has been done in a country where the experience of fifty years is embodied in the present facilities offered both by individual enterprise and by the various governments to the student of agriculture, and where the best intellect and scholarship of the land are employed in the interest of agriculture and the sciences on which it is based.

German agriculture should not be considered under this one title, as the various German states present peculiarities not common to all; but too much space would be required for a detailed account of the interests of scientific agriculture in each German state.

During my investigations I have visited schools of all the various grades existing in Prussia, Saxony, the grand duchy of Baden, Würtemberg, and Austria; and in this report I have selected one or more institutions representing each of the grades or types of the schools of agriculture in Germany.

The controversy which most interests our country is that existing

between the advocates of separate agricultural schools (colleges or academies) and the advocates of agricultural education as a part of the university course. This controversy is still going on in Germany, and, as facts are the best logic, I am compelled to decide that the greater strength of argument rests with the advocates of university education. Not, however, in favor of the complete merging of the agricultural academy or school into the university course, but in favor of a union with the university. Though there are advocates of the complete disestablishment of the academies of agriculture, in favor of the universities, it has been found in practice that, to some extent, a separate faculty and a separate organization for the agricultural department are necessary, and that the university department of agriculture should in a degree resemble an agricultural academy, so allied with the university as to open to the students certain university advantages that cannot be secured in separate academies; and my observation of the working of some of these universities is, that some modification must be adopted to give directness to the studies of the agricultural student.

At the University of Halle, where agriculture is a department in the university, and where there are more agricultural students than in any other institution in Germany, there is a laboratory wholly devoted to experimental and practical agricultural chemistry, under the management of Dr. Stohmann, a most thorough chemist, and an experimental farm of eighty acres, under the director of the experimental station, and professor of agriculture, Dr. Julius Kühn, who is one of the most popular teachers in Germany. Last winter when I visited Halle there were one hundred and eighty-five agricultural students in the university.

At Leipzig University, where it is claimed that the student of agriculture can best be provided for in the university proper, it is still found to be an advantage to aid the student in his specific aim by a six months' course, furnished by an academy at Plagwitz, two or three miles distant, before entering the university. At Plagwitz a large model farm is accessible to students, and also manufactories of various kinds.

Among the advocates of university advantages for the student of agriculture there are two distinct classes, one class contending that the department of agriculture should be constituted of the professors of the various sciences on which agriculture is based, giving the lectures an agricultural bearing or tendency, and adding a few special courses upon the subject directly; the other class contending for a separate and distinct organization, with a full faculty, &c. Both agree, however, that the university is the true seat or center of learning, into which, or around which, students of agriculture should be gathered. Of the first class, Dr. Carl Birnbaum, the able director of the Academy of Agriculture at Plagwitz, and professor in the University of Leipzig, is an advocate. The following is the substance of his argument:*

The first impulse to scientific agriculture in Germany was given by the result of investigations and experiments in England and the Netherlands. The earliest step was the establishment of professorships of agriculture in the German universities. In accordance with the spirit of the age, student life presented few attractions to practical workers; therefore the influence upon the masses was of an indirect nature.

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* For the unabridged argument of Dr. Birnbaum, see the "Mittheilungen über den Lehrplan, die Lehrhülfsmittel u. die Einrichtungen der mit der Königl. Universität Leipzig verbundenen landwirthschaftlichen Lehranstalt Plagwitz," 1865.

Through these professorships opportunity was offered for officials and overseers to gain advanced ideas, and from them the contest was carried to the peasantry, between the old manual-labor system and science with the resulting improvements. Thus came the introduction of machines, stall-feeding, artificial food, root crops, and rotation of crops in place of fallowing. But results were slow because the opportunities for practical application of the principles failed in the universities. Dr. Albrecht Thaer, the great reformer of German agriculture, recognized the necessity of observation as an element of instruction, and was the founder of the first academy of agriculture on his model farm, Möglin. Other academies in connection with model farms soon followed.

Little by little the professors in the universities, ignoring the practical in the department of agriculture, failed to keep pace with the rapid progress made through observations and experiments. The result was that soon their teachings contradicted known practical results. An exodus from the lecture-rooms of the universities followed, and in this popular protest against mere theoretical teaching, it was almost forgotten that from these sources had flowed the streams of scientific knowledge now quickening and fertilizing the land. Thought and effort were now turned to broadening and deepening the scope of the academies. Still, in the academies there was wanting, and must be wanting, the breadth of culture possible in a university. Many lectures, most invaluable to agriculturists, which belong to university courses, are not given in academies, because their bearing upon the immediate subject is not sufficiently apparent. Concentration must be the central idea of special agricultural academies. Because of the limited time given by most students, the subjects under consideration must be restricted to those most immediate and important.

G. Fr. Schulz, as early as the third decade of this century, claimed for agriculture a broader development and the retransfer of agricultural education to the universities. In Jena and Greifswald sprang up through his influence such agricultural institutions, and Bonn and Göttingen followed the example. Liebig has attacked the academies with severity, and the result is a bitter strife as to the most desirable organization for agricultural institutions. In our day, when there is no scarcity of model farms, the disciples of progress are tempted to repeat the ingratitude shown the universities, by forgetting that for all the practical methods of progress the academies are to be thanked.

The need of experimental farms and chemical-agricultural stations appears in the foreground, and that academies have not sufficiently appreciated this need is proved by the rapid establishment of these centers of experiment, and the exceptional cases in which they stand connected with academies. The author, while admitting fully the advantages up to this date conferred by the academies, and the beneficial direction they have given to agricultural effort, is in favor of their complete absorption by the universities. But he claims that the universities must afford every opportunity for a most thorough and complete special course of agriculture.

Möglin, the first academy of agriculture, was the first to disappear as an independent organization, and reappear in connection with Berlin University. Waldau, in East Prussia, followed, and the disestablishment of Tharand Academy is in prospect. Halle established a moderately complete agricultural institution several years ago, and in Breslau, notwithstanding the flourishing condition of the Schleswig Academy at Proskau, a similar department has been organized. In the middle of the nineteenth century, therefore, the course of agricultural instruction

is again gradually taking its place in the curriculum of the university. If agriculturists are to study to good purpose, however, there must be in the university the same opportunities for a thorough course in agriculture as exist in other departments.

From these considerations there have been founded at certain universities, as Bonn (Poppelsdorf), Jena, Greifswald (Eldena), special institutions similar to agricultural academies, but in unity with the universities. These institutions have their separate corps of professors, and the students pay one tuition fee for the advantages of university and special school, and besides the course of the latter they can, as far as time, means, and distance will allow, hear the university lectures; but they appear as occasional students, and remain strangers to the peculiar life of the university. By paying a united or total tuition fee, the distinguishing right of a German student, free choice of teachers, is abridged. Many claim this as an advantage, as the student of agriculture, having a free choice of lectures, might not select such as bear most directly and fully on the special purpose of study; and as a consequence their studies fail in concentration or continuity. Admitting this advantage in institutions thus organized, and their adaptation to certain students who might be versatile and diffusive, it may be answered that the development of self-reliance in farmers is the first necessity in a course of study, that they may be adequate to independent investigations and individual action, and that a fixed course of study does not tend to such development. On the other hand, a due consideration of the needs of agricultural students must be insisted upon; and the lectures of universities have an adaptation to their ends.

As yet agricultural students cannot be matriculated without having finished the gymnasium course, and many insist that this requirement must be continued. Since a certain practical experience in agriculture is necessary, this requirement should be relaxed in favor of agricultural students; and if applicants fail in points requisite to entrance upon a university course, there should be a short preparatory term, as a special course of reading is often necessary to jurists, medical students, &c. This bridge between self-preparation and the university course is furnished by an organization like that at Plagwitz. It, too, has its separate corps of professors and a united tuition fee; but the course is only six months—just the tie between the preparation and the university. For those fitted to enter at once the agricultural department of the university, the necessity for this six months' course does not exist. Still it is recommended as an advantage, since students enter upon the university course with a certain preparation and self-confidence as the result of this brief term of study, and a warm class feeling exists among those who pass from the academy together, which is a stimulus to study. The nearness to Leipzig allows students to hear both the academy and university lectures, and to combine the advantages of a university town with the practical opportunities offered at Plagwitz. Students desiring it have a common home under the control of the director. Only such lectures are delivered at Plagwitz as require experiment or demonstration.

In favor of the other mode of securing for the student of agriculture the advantages of the university, Dr. Edward Hartstein, director of the Poppelsdorf Academy, is an able advocate. The following is briefly the substance of his argument:* "From those who favor the entire dis-

* For the full statement of Dr. Hartstein's views, see "Die landwirthschaftliche Akademie Poppelsdorf, als Beitrag zur Geschichte und Beurtheilung der landwirthschaftlichen Akademien," of 1864.

establishment of agricultural academies and their reorganization as departments of universities, the favorite charge against the academies is their 'one-sidedness' or specialty, and the claim made in behalf of university education is its universality of culture. The accusation against academies and the advantage claimed for universities are a mere form of words, however, unsustained by facts, as an investigation of the university system will prove. Universities do not offer universality of culture. Like agricultural academies, mining schools, polytechnic institutions, schools of art, &c., they are preparatory schools for special life pursuits, not places for that process of diffusion celebrated under the name of universal culture. The division of the universities into four or five departments (as is done in high schools) proves that, to reach their purpose of preparing students for the practical callings of life, there must be a division of studies in accordance with the aims of students. The judicial course is for the study of law, and a demand that the legal student should devote himself at the same time to general scientific and medical studies would be unreasonable. The medical department is also a well-defined course of preparation for one decided life career; and not less clearly defined is the theological course. Those who wish for a thorough revolution in the method of agricultural study do not think of these well-organized and clearly-defined courses, but expect undefined and mysterious advantages from the absorption of agricultural academies by the philosophical departments of universities. And yet universities complain that the philosophical department, on account of the diversity of its interests, fails in directness. This department includes history, physiology, philosophy, the natural sciences, and mathematics. The desire is to open all these sources of knowledge to the students of agriculture, overlooking the fact that the philosophical department is subdivided into special courses, according to the life aims of the student. No student has yet appeared so universally gifted that he has taken all the heterogeneous courses of this department. No one mind can drink from all these fountains. Even one department, the fourth of a university, is too copious for the capacity of single minds. The proposition to divide the philosophical department into two or three departments, now under consideration in different universities, proves how empty is this term 'universality of culture'—a possibility never reduced to a reality. Universities do not exist for the development of universal geniuses, but for the education of useful men for the different pursuits of life. As to the accusation of 'one-sidedness' which is made against the academies, if this means that chemistry, physics, and other branches of the natural sciences are studied, not in their whole compass but only so far as bearing upon and serviceable to agriculture, this is admitted; but why does not the same reproach rest upon students of medicine, who, equally with agriculturists, study natural laws in their relations to the profession chosen, not in their complete range and illimitable possibilities? The world has need of good physicians and good agriculturists, but neither need to be accomplished naturalists; with neither is the end furtherance of science, but such a knowledge of the laws of nature as may be available in the pursuit of their respective vocations. The only way in which academies might advantageously become parts of universities would be by the organization of separate agricultural departments with corps of professors and all the practical accessories of experimental farms, &c., &c.; and this would have no advantage over a separate organization, as agricultural academies in connection with universities, as is the case with Poppelsdorf, having its own faculty and government but still allied to the university, the students of the academy being matric-

ulated at the university. For the teachers, the advantages of residence in a university town, association with professors in other departments, and all the accessory benefits of a university, are marked. Then certain of the lectures at the university are available for the students of the academy upon subjects associated with agriculture, yet not warranting professorships in the agricultural institutions. Again, access to the collections and library of the university offer advantages hardly possible to gather about an independent academy. Of all the advantages which follow university matriculation, however, that of association with students in other departments is considered the greatest. By matriculation, academy students have the same rank as university students. Independent academies, with agriculture as the single aim, are apt to give a too exclusive tone to the whole life; so that in this respect, and in this respect only, may the charge of 'one-sidedness' be feared—not in the course of study, but in the social life. By mingling with students of the various departments of a university, the free interchange of opinions, the introduction of subjects bearing upon their different courses of study, reciprocal sympathies and interests are awakened which keep the agricultural student from being merely an agriculturist, the legal student from being merely a jurist. This recognition of the studies and aims of others may give socially an approximation to that 'universality of culture' which might not otherwise be possible. Study must be specific, but sympathy may be universal."

My own opinion is, that well-organized agricultural departments in our American universities are the first and the leading demand, not only for the promotion of scientific agriculture in the United States, but to lift practical agriculture into a thorough system and to its highest development. Not a mere agricultural professorship, but a complete department of agriculture, with at least two able professors, one of practical or applied chemistry, and one of agriculture; with courses of lectures adapted to agriculture by a half-dozen more of the professors of each university; and the use of an experimental farm where demonstrations may be given having a practical bearing upon the lessons of the course. In every consideration of economy, thoroughness, and comprehensiveness, such schools of agriculture must rank before separate academies. The mere physical advantages that must constitute a part of the accessories of any good university offer advantages to the student of agriculture such as it is almost impossible to accumulate for a separate academy; such as chemical and philosophical apparatus, collections in botany, zoology, geology, mineralogy, libraries, &c. In the employment of the best talent, even supposing it to be possible to secure it in connection with separate academies, the argument is greatly in favor of university departments. Take for example the department of agriculture in the university at Berlin, Prussia. Professor Rose, the distinguished mineralogist and geologist, who has a world-wide fame, is employed to deliver a special course of lectures (two each week) extending through one quarter, for two hundred thalers ($150 in gold.) His services, if they could be secured at all for a separate academy of agriculture, would cost $5,000. But he is a professor in the university, and has his regular salary independent of the agricultural department. Professor Karl Koch, the botanist, delivers a full course of lectures in the agricultural department for four hundred thalers, and Dr. Knej delivers a course of lectures on the physiology of plants for two hundred thalers. Thus it will be seen that economy and the opportunity of securing able instructors are in favor of connecting agricultural instruction with the university. For a complete canvass of the advantages of

different methods of instruction, the claims of separate academies cannot be overlooked. The academy at Hohenheim long ranked as the pattern of an agricultural school in Germany, and to a great extent for other countries. Many of the most eminent agriculturists look to it as their alma mater. Liebig, I believe, first raised the question as to whether a complete agricultural education could best be attained in isolated academies or in agricultural departments of universities. Since then the advocates of the university plan, in one form or another, either by combining institutes or academies with the universities, or by creating departments of agriculture in the universities, have become very numerous, and the growth of such institutes or departments has been very great both in number and prosperity. This growth has been marked in Prussia, even where the Ministerium of Agriculture for a time, at least, struggled against the change. I doubt not, however, that the separate schools will continue to be necessary. It is chiefly where great scholarship is called for that I would recommend the university departments; and to secure this a thorough preparation must be required as a condition of entrance. In all countries, and particularly in our own, there are multitudes of young men who would be glad to know the rudiments of scientific agriculture, sufficiently to relieve their life-calling from being a mere physical drudgery. These can neither get the requisite preparation to enter the university course, nor the time to pursue it if they were prepared. Various grades of agricultural schools will therefore be called for, and can easily be provided by private enterprise, or by private enterprise aided by the States or by societies, (as is the case in Germany,) as soon as we get educated men for teachers. First of all we must provide wide scholarship, either by university courses or by academies of a very high grade. By this means we may secure a class of competent men for professors and teachers, and for the work of high experimental agriculture, and at the same time afford means of culture to all who can unite with an agricultural training a liberal education. Schools for special branches, and also schools of the various grades, will naturally follow. Dr. Komers, of Prague, chief director of the Tetschen-Liebwerd Academy, and one of the most energetic teachers of scientific agriculture in Germany, whose study of the methods of instruction has been profound, expresses most emphatically his belief in the necessity of three distinct grades of agricultural schools, to meet the wants of all classes of students, viz: 1st, a high school, such as a university department would be; 2d, a middle school, such as the agricultural academy; 3d, a lower school, such as the *Ackerbau-Schule*. The first, for securing accomplished scholarship such as would fit men for professional careers; the second, to educate overseers of estates and owners of small estates, and all such students as could enter upon the course of study with some rudimentary knowledge of the sciences relating to agriculture, and yet could not take the higher course; the third, for a class of men who wish a thorough practical training in agriculture, working with their own hands, but who cannot come with any previous preparation to enable them to comprehend strictly scientific lectures.

The Ackerbau schools of Germany are among the means adopted to extend the results of scientific investigation to the masses. In Germany much attention is being given to this subject, and it is a much more difficult one to deal with there than it can ever be in our country. We might be inclined to award to Germans the credit of being a practical people, judging by the results of their industries, if we did not know how immeasurably beyond their practice their theories are. There is no nation where theory and practice are so disassociated as in Germany,

where science is so much in advance of its practical application—where there is such a difference between *knowing* and *doing*.

Could space be afforded to fully consider the progress of scientific agriculture in Germany, the questions growing out of this need would prove most fruitful in instruction, particularly such as pertain to the methods of instruction, viz., the questions as to how far agriculture can be taught in the *Volks-schule* (common schools,) the organization of normal agricultural schools, the appointment of wandering teachers, and the establishment of casinos. I do not believe that agriculture can be introduced as a branch of study into the common school. Even were the children mentally ready for such studies, which they are not, all the period of life that belongs to the common school is needed for development in general directions; not that the teacher may not draw largely, in the way of illustration, from many of the practices in agriculture and from some of the rudiments of the science of agriculture, for the quickening of observation and broadening of the comprehension of his scholars; but there is a period of life (student life) when most of, if not all, the sons of American farmers might be provided with special agricultural instruction to great advantage—such winter schools as are being inaugurated in the grand duchy of Baden. The question recurs, how are we to secure competent teachers? And we are thrown back upon the work that must antedate any great multiplication of schools of agriculture. If we scatter our resources at the outset by the establishment of a multitude of schools, academies, and colleges of agriculture, the result will be that we shall secure only a low standard of agricultural education—at best, only a sort of half education; and any effort to deepen and broaden the system will, ten years hence, be surrounded by difficulties far greater than now exist. To revive any system that has fallen into disgrace, to renew an undertaking that has failed of success, is far more difficult than to originate and perfect an enterprise that can be commenced free from prejudices. Since there are no less than one hundred and fifty agricultural institutes, university departments, academies, schools, and stations in the German states, it is not practicable to give a description of all of them. The systems adopted in the organization of the various grades of schools, and the methods of instruction in use, can best be understood by a statement of the departments of study embraced and their distribution in the courses, which will be undertaken in the following pages.

The Royal Institute or Academy of Agriculture at Poppelsdorf, near Bonn, on the Rhine, represents one class of schools, in which the student of agriculture has university advantages, by the union of the institute with the university. The course of study of the University of Leipzig, where agriculture is a department in the university, is given, not because the organization is superior to that of the University of Berlin or Halle, but because the course is preceded by a preparatory course at Plagwitz, which course is also presented. Of the separate schools or academies four have been selected which are believed to represent comprehensively the academic system for general agricultural education in Germany. There exist many special schools for single departments of study, such as forestry, fruit culture, flax culture, horticulture, veterinary surgery, &c., but these have not been selected. The highest class of separate schools might be still further represented by the Royal College of Agriculture and Forestry at Tharant, in Saxony; by that at Altenberg, in Hungary; by that at Proskau, and by many others; and those connected with universities, either as departments or institutes in union with universities, by the universities of Berlin, Halle, Göttingen, Vienna,

Eldena, &c.; but this would involve much repetition and require considerable space. Justice could not be done to an account of the agricultural experimental stations of Germany, except by a very lengthy special report on that subject. Much could be said in praise of the work these stations are accomplishing both for the advancement of the science and the art of agriculture. This work is not confined to the investigation of the nature of soils, and the best methods of enriching them, and the nature and growth of all that the soil can be made to produce in the vegetable kingdom, but embraces also the best methods of utilizing these products for the food of man and beast. It will be seen, however, by the annexed brief account of these stations that they are of recent origin, and followed the work of the agricultural schools.

The academy of Tetschen-Liebwerd, though much newer than many of the other schools, deserves a much more detailed account than I have been able to give. The State Agricultural College of Michigan is the only institution in the United States of the class of Hohenheim and Tetschen-Liebwerd that may be considered as highly successful. The hope of America, and to some extent of other nations, is turned towards the Cornell University for an example that will broaden and liberalize indus trial education, not only in agriculture, but in all the departments of art, trade, and science; but the leaders in that university, no less than in the Industrial University of Illinois, and in all the institutions of the various States founded, or to be founded, under the stimulus of the government grant of lands for agricultural and mechanical education, will find that the more they study the causes that have led to the success or failure of other institutions having the same or similar aims in view, the sooner they will attain the highest usefulness and prosperity.

THE ROYAL INSTITUTE OR ACADEMY OF AGRICULTURE AT POPPELSDORF.

Poppelsdorf is one mile from Bonn, on the Rhine, through beautifully shaded walks. The natural history collections of the University of Bonn occupy an old palace at Poppelsdorf, and the new chemical laboratory just completed is situated here also. This is one of the very best laboratories in Europe.

The academy at Poppelsdorf has two farms, one at Poppelsdorf of one hundred and twenty *morgen*,* another at Annaberg of one thousand morgen. The field for experiments contains about twenty morgen. The academical farms receive no subsidies from government, but they yield a considerable amount of rent. The field set apart for experiments, and the experimental station or branch receive an annual subsidy from government of four thousand thalers. Besides the field set apart for experiments, a smaller farm is requisite during the term of instruction. The students are not practically employed on the farms, as they are supposed to have acquired the practical part of farming before entering the academy. The academy is exclusively supported by the government, and the annual expenditures of the institution amount to twelve thousand thalers. There are fifteen instructors, viz: three in the different branches of agriculture, two in chemistry and technology, and one each in botany, physics, geology, zoology, foresty, veterinary surgery, mathematics and architecture, gardening and rearing fruit trees, national economy, and in agricultural jurisdiction. The weekly lectures of the several teachers vary from three to seven, and the entire course

* In Koln a *morgen* is 0.7850 of an acre.

extends over two years. The course for the summer commences on the 15th of April, and lasts until the 15th of August; the winter course extends from the 15th of October to the 15th of March.

Though the students are not practically employed on the farms, practical courses of chemistry, botany, and physics are introduced, during which the students are employed, with the assistance of the teachers, in solving chemical, vegetable, and physiological problems; the result of these studies of natural science is of the greatest importance to the students. The teaching is carried on in the form of lectures. The whole premium payable for two years amounts to one hundred thalers, viz: seventy thalers for the first, and thirty thalers for the second year. The lowest age for admission of students is seventeen years, but the greater number of the students are of the age of twenty to twenty-five years. The number of students at the last term was ninety. The aggregate number of students in this academy is eleven thousand. The students are matriculated in the University of Bonn, where they enjoy the same rights as the university students. The following is the distribution of the different branches of teaching in the four terms of the biennial course:

FIRST YEAR.—*Winter term.*—Introduction to agricultural studies:

I. Agricultural exercises: 1, economical basis of agricultural science; 2, the science of manure; 3, general science of animal production; 4, agricultural book-keeping; 5, agricultural literature, with particular reference to new publications; 6, rearing of fruit trees, with practical illustrations; 7, practical agricultural illustrations.

II. Forestry: 1, the use of forests, care and valuation of them, with practical illustrations; 2, the chase and fishery.

III. Natural sciences: 1, inorganic experimental chemistry; 2, analytical chemistry, with practical lessons in the laboratory; 3, chemistry of the soil; 4, geology and geognosy; 5, general botany, and anatomy of plants; 6, microscopic studies; 7, anatomic and physiological view of the animal creation; 8, natural history.

IV. Mathematical exercises: agricultural mechanics, and science of machinery.

V. Economy: science of national economy.

VI. Jurisprudence: agricultural jurisprudence.

VII. Veterinary surgery: 1, anatomy and physiology of domestic animals; 2, exterior ailments of domestic animals.

VIII. Technology: general technology.

IX. Architecture: 1, construction of agricultural buildings, and industrial undertakings; 2, lessons in drawing.

Summer term.—Introduction to agricultural studies:

I. Agricultural exercises: 1, comparative illustration of the agricultural condition of the principal European countries, particularly of England, with particular reference to Germany; 2, culture of cereals and vegetables for feeding purposes; 3, agricultural implements and machinery; 4, rearing cattle; 5, exterior knowledge of horses; 6, culture of wine and vegetables, with practical illustrations; 7, agricultural illustrations and excursions.

II. Forestry, with practical illustrations.

III. Natural sciences: 1, organic experimental chemistry; 2, experimental physics; 3, analytical chemistry, with practical lessons in the laboratory; 4, agricultural literature treating of chemistry; 5, agricul-

tural botany and ailments of plants; 6, physiological lessons on plants; 7, natural history of invertebrate animals; 8, statistics of natural sciences; 9, botanical excursions.

IV. Mathematical sciences: practical geometry, and lessons in measuring land and leveling.

V. Economy: the policy of national economy.

VI. Jurisprudence: agrarian jurisprudence.

VII. Veterinary surgery: acute and infectious diseases of domestic animals.

VIII. Architecture: 1, knowledge of building materials, and lectures on architectural construction; 2, lessons in drawing.

SECOND YEAR.—*Winter term.*—Introduction to agricultural studies:

I. Agricultural exercises: 1, the systems of agriculture, management of large farms, and planning; 2, tillage, drainage, and sowing the soil; 3, agricultural calculation; 4, literature of agriculture, with particular reference to the newest publications; 5, breeding of sheep and knowledge of wool; 6, rearing of fruit trees, with practical illustration; 7, practical agricultural illustrations.

II. Forestry: 1, the use of forests, care, and valuation of them, with practical illustration; 2, the chase and fishery.

III. Natural sciences: 1, inorganic experimental chemistry; 2, experimental physics, meteorology; 3, analytical chemistry, with practical lessons in the laboratory; 4, mineralogy and geology; 5, the physiology of plants; 6, microscopic studies; 7, natural history of vertebrate animals; 8, agricultural statistics.

IV. Economy: science of national economy.

V. Jurisprudence: introduction to agricultural jurisdiction.

VI. Veterinary surgery: anatomy and physiology of domestic animals.

VII. Technology: technology of the industrial branches of agriculture.

VIII. Architecture: 1, construction of agricultural buildings and industrial undertakings; 2, road-making and water works; 3, lessons in drawing.

Summer term.—Introduction to agricultural studies:

I. Agricultural exercises: 1, valuation of farms, and calculations as to yields; 2, culture of commercial produce; 3, knowledge of the soil, and plans for improving the same; 4, management of meadows; 5, history and statistics of agriculture; 6, rearing and breeding of the smaller domestic animals; 7, medical treatment of domestic animals; 8, culture of wine and vegetables, with practical illustrations; 9, agricultural illustrations and excursions.

II. Forestry, with practical illustrations.

III. Natural sciences: 1, organic experimental chemistry; 2, experimental physics, electricity, magnetism, sound, and light; 3, chemistry of the animals; 4, analytical chemistry, with practical lessons in the laboratory; 5, literature of chemical agriculture; 6, agricultural botany and elements of plants; 7, selections from general botany, and the anatomy and physiology of plants; 8, physiological lessons on plants; 9, statistics of natural sciences; 10, botanical excursions.

IV. Mathematical sciences: practical geometry, and lessons in measuring land and leveling.

V. Economy: the policy of national economy.

VI. Jurisprudence: agricultural jurisprudence.

VII. Veterinary surgery: acute and infectious diseases of domestic animals.

VIII. Architecture: 1. knowledge of building materials, and lectures on architectural construction; 2. lessons in drawing.

AGRICULTURAL SCHOOL AT PLAGWITZ, NEAR LEIPZIG.

This school is preparatory to entering upon the agricultural course in the university of Leipzig, and embraces a term of six months. The following is the course of study:

History and literature of agriculture; elements of physics and chemistry, with instructions in the small laboratory; introduction to botany, with the use of the microscope; anatomy of animals, with study of horse-shoeing; field measurements, leveling, and drawing of plans; book-keeping and study of exchange; introduction to mineralogy and geognosy; practical demonstrations and exercises.

Students can, also, according to their time and wish, attend certain of the university lectures.

AGRICULTURAL COURSE IN THE UNIVERSITY OF LEIPZIG.

Agricultural lectures and associated subjects:

Study of plants, meadows, and stock-raising, and estimates of yields or returns; sheep-raising, and study of wool; care of domestic animals; associated manufactories and technology; agricultural chemistry, and practice in the large agricultural-chemical laboratory.

Lectures on accessory sciences: Inorganic and organic chemistry; mathematics, physics, and mechanics; botany; zoology, comparative anatomy, comparative osteology, and physiology of animals; mineralogy and geognosy; universal mathematical and physical geography; meteorology and astronomy; political economy; historical science; literature, and history of literature; philosophical sciences.

The total tuition fee for the six months' course at the academy at Plagwitz is sixty thalers. For the succeeding terms at the university, or for those who enter at once upon the university agricultural course, there are fifteen thalers per term to be paid to the academy, and for the use of the laboratory special fees, according to circumstances. The payment of the fifteen thalers secures the right to the academy lectures and the lectures of the director at the university. At the university, for four hours' lectures a week, for the entire term, four and five thalers; and for two hours' lectures per week, two and three thalers for the term are charged.

HOHENHEIM ACADEMY.

This academy was the first of the separate schools visited, and is perhaps the best known of the German academies of agriculture. My visit to the institution was on the occasion of a meeting or congress of German agricultural chemists, officers of the agricultural experimental stations, and friends of agricultural chemistry generally. Nearly all parts of Germany were represented, as well as several other countries. The subjects presented at the congress, either in the form of stated papers or discussions, and their titles indicate fully the character of the meeting, and also, to a great extent, the character of German effort for the advancement of agriculture. German scholars occupy them-

selves almost exclusively with the technical and strictly scientific bearings of the subject. It would be almost impossible at such a meeting to introduce any question relating to the practicability of making available to the masses the very principles evolved or discussed. Scientific facts and theories absorb the entire energy of most German scholars. The following subjects and allied questions occupied the entire attention of the meeting: Analysis of foods; ash analysis of agricultural substances; investigation on the feeding of animals; cultivation of plants in water; control of the manure trade by experimental stations; relations of food, and cost; appropriation of food, (in relation to experiments on the subject;) manuring; analysis of harvest products; soil analysis; results of experiments on feeding, vegetation, and manures.

The congress assembled August 17, at 10 a. m., in the "balconsaale" of the castle, and, after the usual preliminaries on such occasions, the reading of papers continued until 2 o'clock, the hour fixed for a public dinner. The afternoon was occupied in visiting the experimental stations, museum, &c., and the evening by a social meeting. The forenoon of the second day was occupied in reading papers and in discussions; the afternoon, by an excursion to the Necker Valley, returning to Stuttgard in the evening. The forenoon of the third day was occupied in visiting the polytechnic schools, museums, and art academies in Stuttgard; and the afternoon, by excursions to Berg and Cronstadt.

By attending this meeting I was enabled to see all the departments of the Hohenhein academy under the very best circumstances, and to meet personally representatives from institutions in all parts of Germany; thus learning much of the spirit of the present workers in agriculture.

Hohenhein is situated on high ground, about two hours' drive from Stuttgard, the capital of the kingdom of Würtemberg. The academy buildings were erected by Duke Charles, in 1770–1780. This princely residence had fallen into comparative ruin, but was repaired by King William and appropriated to the use of the agricultural academy, which was founded in 1818. The school is located on the royal domain, and is sustained and directed by the State. It commenced with only eight students under the directorship of Baron Nepomuk Schwerz.

At the present date this institution consists of three separate schools as well as a number of extraordinary courses, such as school teachers' course, fruit-growers' course, meadow-culture course, and shepherds' course; also special courses for government officers, and a course for bee and silk-worm management.

The first of the three schools is the academy, which embraces a full course of instruction in all the branches of agriculture, including forestry, and requires two years for its completion. Students are expected to be eighteen years of age when they enter. The second is an agricultural school for men whose practical education is the main object. They receive instruction in the lecture-room about two hours daily, morning or evening, and the entire day, with this exception, is spent in actual labor. This department is open only to residents of Würtemberg, and the number of students is limited to twenty-five. The course covers a period of three years, and students are admitted at sixteen years of age. The third is the horticultural school, to which only six students are admitted annually. They must be seventeen years of age, and are required to have served a three years' apprenticeship in gardening or in the vineyard, or to have gone through one course in the agricultural school. The student is thus expected to get a complete education, both theoretical and practical, in all that pertains to horticulture.

The purpose of Hohenheim to educate large land owners, overseers, officials for public departments, &c., in agriculture and forestry, is thus supplemented by schools for the ordinary farmer, (*ackerbau-schule*,) and by short special courses for such students as desire to devote themselves to some one department.

Two years are required for the thorough and finished course in either forestry or agriculture, and I regard this as being entirely too little time for the studies embraced in the course. Yet the lecturers treat the principal subjects in agriculture and natural sciences within the space of one year, from the fact that many students cannot remain a longer time, and thus they are supposed to have the benefit of a complete course of lectures. This cannot be undertaken without too great crowding of studies, with superficiality as the result. The accessories of this institution, in the way of museums, model collections, &c., are excellent, and the apparatus for demonstrating manufacturing processes are as complete as such facilities can be made in an isolated situation, where they must be created solely for the purpose of demonstration. In such cases the progress of invention, as urged on by the necessities of competition in actual business, cannot be fully represented. The museums consist of model collections of farming implements, machines, &c.: of Professor Fleischer's mineralogical collections: well arranged geological collections: collections of varieties of soils, seeds, and herbs: models in pomology, &c.: zoological collections: and collections of native woods, in longitudinal and cross sections. In the facilities for practical or applied chemistry are embraced: factories for beet-root sugar, brandy, starch, vinegar, fruit-drying, new wine, a beer brewery, &c. The sugar fabric has the press method and Dombasleschen maceration process, both with steam-heating. It is in operation only in November and December. In connection with it is an arrangement for the preparation of bone coal. The beer brewery is arranged for the making of fifty to seventy *cimers** of beer in January and February, after different methods. Brandy is prepared from potatoes, grain, molasses, and brewery residuum, one-half *cimer* daily: the time of operation being according to the needs of instruction. The managements for starch, vinegar, &c., are on a smaller scale, chiefly for the purposes of demonstration. The agricultural experimental station was completed in 1866 at a cost of 15,000 florins, and embraces experimental stalls, hot-houses, and experimental gardens and fields. There is also an agricultural machine factory, the shops now being let, reserving the privilege of access for the students. The entire grounds connected with the institution, exclusive of forests, amount to 971⅜ *morgen*, or about 770 acres. These grounds may be looked upon as experimental land on a large scale rather than as a model farm. The land is divided as follows: Tilled land, 615 *morgen*; meadow, 149¼; tree nursery, 21⅜; experimental fields, 29⅛; fruit-tree nursery, 16⅞; hop garden, 4⅜; botanical garden, 14⅜; vegetable and flower garden, 3⅝; vineyard ⅜; practice field for students, 1⅝; woods or spots unfavorable for culture, and banks of streams, 11⅝; buildings, 11¼; roads, pasture, and sheep range, 76⅝; leased part of the estate on account of unfavorable situation, 14⅜.

The average amount of live stock kept is sixteen horses, twenty oxen in the hay harvest, eighty to one hundred cows, and six hundred to one thousand sheep.

There are in this institution twenty professors and teachers. The principle of division of labor, so fruitful in good results, is practiced. The

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*An *cimer* in Würtemberg is 70.59040 gallons.

professors, therefore, have leisure and strength for scientific investigation and experiments. This system cannot be too highly recommended for adoption in our own country.

The number of students at present is one hundred and twenty-five, and the aggregate number from the commencement about three thousand six hundred and fifty. Prizes are given among the students for the best essays on agricultural subjects. Examinations during the term or at the close of the course are optional; certificates are, however, granted only to those who pass. Würtemberg students of forestry must undergo an examination before admission. Foreign students of forestry and all students of agriculture enter without such conditions, only a general fitness for the understanding of the lectures being required. Occasional students are not allowed a stay of more than four weeks. Cost for residence and instruction of students: For foreigners, three hundred florins for the first year, and two hundred florins for the second year; for students of the country, one hundred florins per year. Students in forestry: For foreigners, two hundred florins; for natives, sixty florins.

Connected with this department of forestry are six thousand *morgen* of forest, exhibiting all, or at least a great variety, of indigenous trees, shrubs, plants, &c., with twenty-five *morgen* for exotics. The cultivation of seeds is practiced on the model or experimental farm, for distribution among the farmers of the kingdom.

The following is the course of study, or plan of lectures, demonstrations, and practical exercises in the Royal Würtemberg Agricultural and Forestry Academy of Hohenhein:

Agricultural course.—1. History and literature of agriculture; 2. General field and plant culture, including the drainage of land; 3. Study of agricultural machinery and implements; 4. Special plant culture, in special lectures; 5. Hop and tobacco culture; 6. Wine culture; 7. Fruit culture; 8. Vegetable culture; 9. Meadow culture; 10. General breeding of animals; 11. Horse breeding; 12. Exterior of horses, in special lectures; 13. Cattle breeding; 14. Sheep breeding; 15. Study of wools; 16. Breeding of small animals; 17. Silk-worm culture; 18. Bee culture; 19. Carrying on of agriculture; 20. Agricultural taxation, with exercises in drawing agricultural plans; 21. Agricultural bookkeeping; 22. Management of the Hohenhein farm; 23. Agricultural technology.

These lectures are united with demonstrations in the agricultural model collections of machinery and tools, wool and soil collections, on the experimental fields, in the nurseries and different gardens, among the live stock of the farm, in the technical work shops; also, practical exercises in agricultural taxation, agricultural excursions, &c., &c.

Forestry course.—1. Encyclopedia of forestry, with particular consideration of the allied studies of forestry and agriculture; 2. Forest botany; 3. Climate and soil adapted to forestry; 4. Forest culture; 5. Protection of forests; 6. Use of forests and forest technology; 7. Valuation of trees, and profits; 8. Forest taxation; 9. Duration of forests; 10. State forests, in special lectures; 11. Würtemberg forest laws; 12. Business in connection with forestry; 13. Agricultural encyclopedia for foresters.

Connected with this course are demonstrations in different forest sections, the botanical garden, and forestry collections, as well as practical exercises in forestry taxation, excursions, &c.

Rudimentary accessory exercises.—1. Political economy; 2. Science of law; 3. Mathematical course, including arithmetic, algebra, planeometry, stereometry, trigonometry, practical geometry. Hereto are joined regular exercises in field measurements and leveling; 4. Natural sciences,

including mechanics, experimental physics, general inorganic chemistry, universal organic chemistry, agricultural chemistry, analytical chemistry, geognosy, introduction to botany, anatomy and physiology of plants, pathology of plants, special botany, anatomy and physiology of domestic animals, general and special zoology, microscopic observations. Connected with these studies are practices in the chemical laboratory, demonstrations in the green-houses and on the experimental fields of the experimental agricultural station, in the botanical garden, in the botanical, mineralogical, anatomical, and zoological collections. There are also botanical and geognostic excursions: 5. Veterinary sciences, including remedies and receipts, pathology and therapeutics of domestic animals, aids to animals in giving birth, shoeing animals, and veterinary clinical demonstrations; 6. Agricultural architecture, including the drawing of plans.

HIGH SCHOOL, OR ACADEMY OF AGRICULTURE, AT TETSCHEN-LIEBWERD BOHEMIA.

The grade of this school is that of a higher agricultural and industrial agricultural academy. The instruction is in German and Bohemian. The first two years are devoted to general agriculture, and the third year to special branches. Instruction by lectures, practice in fields and the manufactories of Tetschen and Bodenbach, excursions, free conversational meetings under the guidance of professors, and the writing of essays. The lectures are not written and delivered, but spoken freely, with opportunity for questions, explanations, and illustrations. Each subject under consideration is treated with some class book as a general basis for study and investigation. Notes on the lectures are taken by the students. Tuition costs sixty florins yearly. The lowest age of admission is seventeen years, and proofs must be produced of the applicant having finished the course of the under gymnasium or lower "Real-school;" also, of some practical preparation in agriculture. Number of professors and teachers, fifteen. At the close of the summer term of 1868 there were one hundred students. The arrangements of the institution are for the admission of not more than thirty students at the beginning of each year, so that ninety is the normal number of students in the institution, as it is composed of three classes. Yearly ten thousand florins have been received from government, since the opening of the academy in 1866, as a national high school; previous to that date, two thousand florins yearly. Whole area of the farm, 1219.8 *metzen*;* leased, 368.4 *metzen*; leaving 851.4 *metzen* farmed by the institution, as follows: Arable land—rotation of crops, 582; border pasture land, 20.7; experimental fields, 3.4; botanical garden, 0.12; grass-seed school, 0.5; hop garden, 0.13; meadow land, 166; boundaries, roads, &c., 65.8.

Other accessories to improvements exist in Tetschen, open to the students, as the beer brewery, flax factory, distillery, beet drying, fruit drying, vegetable garden, vineyard, chemical experimental station, forests, library, philosophical, chemical, and mathematical apparatus, mineral collection, zoological collection, varieties of soil, workshops for agricultural tools and small machines, cocoonery, apiary, &c.

In 1850 Tetschen-Liebwerd was established as an agricultural school for the peasantry, under the protection of Count Thun, on the farm Liebwerd, given by him for the purpose. It was organized on a plan of Director Komers, who, with four professors and teachers, constituted

* A *metze* is 0.4739 of an acre.

the faculty. This was the first agricultural school with German instruction in Bohemia. In 1856 it was reorganized under Director Komers, with a higher and lower department—the courses distinct. The higher department received from the Royal Economical Society a gift of twenty-one hundred florins, and the buildings were enlarged at the cost of the Protector, Count Thun. The organization of the experimental station, under Dr. Th. von Göhren, took place in 1864–'65. The formal opening of the institution as a high school of the Kingdom of Bohemia was in 1866. There is an examination every term, with classification of students. The first three receive prizes, with publication of their names. Particular attention is called in the report to the need of occasional travel by representative professors, to compare the operations and results of other institutions; in the case of Dr. von Göhren, whose able report on Lichtenhof, Weihenstephan, Hohenhein, and Grignon, was the result of such a journey.

After the two years' general study of agriculture, there is a division of the third year into four courses: 1st. General administration of estates, with rational stock raising; 2d. Agricultural technology, sugar making manufacture of brandy, beer, oil, &c.; 3d. Agricultural engineering, and science of reclamation; 4th. Agricultural-industrial improvements.

In the second year the students are divided into four classes, in the management and overseeing: 1st. The local direction; 2d. Administration; 3d. Account of the revenues; 4th. Natural accounts.

The first year they are busied in a varied manner, in house, on fields, &c. Students who work as a part payment are allowed thirty-eight to forty kreutzers. The soil at Liebwerd is, in the portions lying in the valleys, hard loam; on the heights, sandy loam, or loamy sand. The working of the soil is very hard. Climate mild and damp. Prevailing winds southeast, northwest, and northeast. In September fogs often roll into the valley at three o'clock in the afternoon, and do not break away until ten o'clock in the morning.

ROYAL BAVARIAN DISTRICT SCHOOL AT LICHTENHOF.

This school is situated near Nuremberg. Its grade is that of a middle school, embracing three institutions: 1st. The District Agricultural School; 2d. The Lower Agricultural School for peasantry; 3d. The Preparatory School. The character of instruction is general agriculture, with rudiments of forestry; the instruction of an order to prepare scholars for the management of small or moderate estates as owners or overseers, or to enter the higher agricultural school at Weihenstephan, or the Central Veterinary School at Munich, or for entrance upon a course of universal practical forestry.

The full cost of tuition is one hundred florins, yearly, for scholars under thirteen years; one hundred and twenty-five florins for those from thirteen to sixteen years; one hundred and fifty florins for all pupils over sixteen years—living included. Twelve years is the lowest age for admission. The course embraces a period of three years. There are two courses: 1st. District school course, inclusive of the preparatory course, when students are not fitted for immediate entrance; 2d. The course in the lower school, for peasantry.

The number of professors and teachers is ten; number of scholars last year, eighty-three. The buildings will accommodate one hundred scholars. The institution has the rents of the Maximilian foundation or establishment. This consists of the estates Lichendorf and Gibitzhof, which are given for the use and purposes of the institution, and the income from

them for free scholarships for poor students. All rents and a subsidy from the district or county funds, with private gifts, amount to from four thousand to six thousand or even eight thousand florins yearly. Connected with the school are an experimental farm, vegetable garden, botanical garden, and a tree school. The experiments with superphosphate have, according to their reports, resulted unfavorably in beet culture, but the experiment will be continued for further results.

This school opened in 1833, with twelve students; at present there are ninety-six. Whole number from commencement, six hundred. The subsidy from the province is seven thousand to eight thousand florins yearly. The receipts of the agricultural journal, "Lichtenhofer Blatter," go toward the establishment of free scholarships. The students form three classes: Those who pay full tuition and board; those admitted at reduced prices; and free scholars. The farm is situated in the "Knoblauchsland;" the subsoil coarse-grained quartz sand, with beds or layers of clay running through it. One peculiar physical feature of this district is the frequent presence of water at a depth of three to five feet, which in many places prevents the use of subterranean cellars. Liebig's doctrine of the absorptive capacity of arable land finds here a striking confirmation, where the soil is of marshy and sandy earth, mixed through culture with a mass of manure stuffs, chiefly mineral. The writer believes that the secret of fruitfulness of this region consists in the mixing of marshy and sandy soil, otherwise he cannot account for the less favorable results of the same experiments in preparation and manuring of the soil upon adjacent sand fields. Only the result of more than one thousand years' alternating plant growth with their decay could be at the bottom of this fertility. The principal experiments are in raising fodder and trade crops, fruit-tree culture, various modes of manuring, bee raising, and crossing of different breeds of cattle. The soil is cultivated to a depth of one and a half to three feet, with frequent manuring at almost every plowing.

WEIHENSTEPHAN ROYAL BAVARIAN CENTRAL SCHOOL.

This school is situated at Weihenstephan, near Treising. Its grade is that of a high school of agriculture. The character of instruction is agriculture, forestry, and stock raising. The full cost of tuition for Bavarians is twenty-five florins half yearly; for all others, fifty florins for first half year, and twenty-five florins for second half year. Sixteen years is the age for admission. The course covers a period of two years. In connection with the usual course are, 1st, a practical preparatory course of one year; 2d, a brewery school of one year; 3d, fruit culture course of two or three years; 4th, trial station for agricultural machines and tools. Number of professors and teachers, thirteen; number of pupils, sixty, (twenty-two in regular course, seventeen in technical course, sixteen in preparatory, five occasional.)

The royal estate Weihenstephan, with seven hundred and ten *tagwerken* (about four hundred and twenty *joches**) of meadow land fields and turf land, belongs to the school. The following may be mentioned among the accessories: Fifty seven cows, four hundred sheep, swine—number variable—botanical garden, hop garden, apothecary for veterinary surgery, brewery, distillery, brick-kiln, lime-kiln, cheese dairy, fishery, turf-cutting field, chemical laboratory, library.

The institution was founded in 1852. Weihenstephan was a Benedictine cloister, established in 725. The expenses of students are: Winter

A *joch* is 1.4223 acres.

term. Bavarian students, for tuition and boarding, including single room, fire, lights, washing, service, and use of reading-room, ninety-five florins; when two students use a double room, the expense to each is eighty florins. For the same items the cost to foreign students is one hundred and twenty florins for single, and one hundred and five florins for double room. Summer term, Bavarian students, single room, fifty florins, (including above particulars,) and double room forty-five florins; foreign students, seventy-five and seventy florins. The second year's expenses for foreigners and native students are the same, the former being reduced to the same plane as the latter. The entire expense for the one year preparatory course is three hundred florins. In the brewery school one hundred florins for practical instruction during the winter term, and eighty for the summer term, are charged. Tuition in the fruit-culture course, forty florins yearly. Under this head mention is made of paying students who choose to labor: twenty-four kreutzers per day in the first year; later, more is paid, according to their ability.

In sheep raising the Southdown bucks have been crossed with merino, and the result promises well. The raising of the pure merino sheep is also an object here. Four hundred sheep and lambs sheared gave eight hundred and six pounds of wool. Experiments have been made in Liebig's substitute for mother's milk in raising calves. Also in the use of greater quantities of malt germs in the raising of young cattle. Great efforts are being made to discover the proper proportion of nourishment containing nitrogen, and that without nitrogen, for grown sheep. The surrounding woods, evergreen and "needle," are used for practical experiments and instruction.

AGRICULTURAL CHEMICAL EXPERIMENTAL STATIONS.

I regard the work these stations are accomplishing, both for scientific and practical agriculture in Germany, as being of the very highest importance. They cannot, however, supersede or even precede the work of the agricultural college. First of all we must have thoroughly educated men (educated technically in agriculture) to conduct these stations. As soon as agricultural colleges can produce competent men, the more experimental stations we can have the better. The following remarks, taken from a sketch of this work by Dr. Theod. von Göhren, will show something of the history, progress, and economy of these stations in Germany:

"The year 1840 (the date of the publication of Liebig's Chemistry) was the birth year of scientific agriculture. Liebig's book was the seed from which already such wondrous growths have been quickened. Adolph Stöckhardt, of Tharand, is the man who, by ceaseless efforts in clubs, schools, and experimental stations, has done most to prepare the soil for the reception of this seed of truth. The question early arose as to the means of linking men of science with the masses. What method would best convey the fertilizing streams of scientific knowledge through channels and ducts to the people? Stöckhardt and others saw, in the establishment of chemical-agriculture experimental stations, a means. The first private experimental farm in Germany was established by Boussingault, in Bachelbronn; but the first true experimental station was founded in 1851, in Möckern. In Prague, an experimental station was founded by the Bohemian Royal Economic Society in 1855, under the distinguished guidance of Dr. Hoffman, which is still in active operation.

"In Mähren an experimental station was founded in Blansko, on the

estate of Prince Salm, by the Royal Schleswig Agricultural Society in 1856, but it was discontinued in 1864. In 1855 an experimental station was established in the most munificent manner by Prince Johann Adolph von Schwarzenberg, in Lobositz, a private enterprise, but connected with it were Dr. Hanamann and Dr. Breitenlohner, highly distinguished in their respective departments. Quite recently, Carl Maximilian, Count von Seilern, the well-known author of 'Nourishment of Plants,' has established an experimental station upon his estate, Prilep, in Mähren. Finally, in Bohemia must recognition be made of the activity of the experimental station connected with the academy of Tetschen-Liebwerd. In 1866 the number of stations in operation in Germany was twenty-eight.

"The first chapters in the history of experimental stations is a record of discouragements, injustice, and partial failure. The development of such an enterprise must necessarily be slow, and the practical results not immediate. But, not considering the series of years needed for experiments, the public exacted speedy and marvelous results. Failing in these, the scheme was denounced as a failure, and popular sympathy and support withdrawn: nor did the strife of the agricultural chemists among themselves tend to raise their authority in the eyes of the practical. For a time the stations seemed to be in a hopeless condition because of this distrust. Now, experimental stations stand recognized in the first line in the service of science. It is less than three decades since agriculture took its rank among sciences. Its first purpose must be, as in the case of every other science, the discovery of truth; then adaptation of that truth to practical ends.

"The most pernicious foes of science are those who constantly demand the useful, and ignore all truth, the immediate marketable value of which is not evident. Reverence for truth must so fill the minds of scientific workers that a false description of the most insignificant plant would be felt as much a reproach as a false description of the solar system. Simple, pure truth must be the end of all naturalists. Science can never accept as her task the discovery of what we wish, but the discovery of what is true: and never can the welfare of mankind be attained by even the pleasantest illusion, except through the complete and simple truth.

"These stations are working great practical good to agriculture; and in the future the results will be more marked. Their task is threefold—to seek, to teach, and to warn.

"A few statistics will show the results of knowing the elements of the soil, the nature of manures, &c. In Belgium, where agriculture is most rationally pursued, a square mile produces means of nourishment for 7,345 persons, whereas the Polish three-field farming produces food for only 2,229 persons per square mile. Therefore the Belgians are better nourished than the Poles, though the country of the latter is more fruitful by nature. Great Britain, in the commencement of the nineteenth century, produced grain for eleven millions; now, for at least seventeen millions. Still the results of searching out the secrets of nature are chiefly in the future. The most important questions look to future experiments for their answer.

"In regard to animal productions, the results of scientific farming are not less marked. Austria produces on one square mile 3,796 head of stock; Prussia, within the same limits, 5,537; France, 5,970; Great Britain, 11,447.

"Added to the questions of plant and animal production is that scarcely less important one of agricultural industrial manufactories, as

breweries, distilleries, refineries, and, above all, sugar manufactories. There is a rumor of a prospective undertaking in Hungary in behalf of the beet-root sugar interest, viz., the establishment of a manufactory with large experimental rooms attached. It is intended to be a complete sugar manufactory, with accommodations for fifty students from various parts of Austria. These students will have the advantages of a large manufactory in operation, and opportunities for study and experiment. The intention is to establish it under government patronage; the whole concern, after a stipulated number of years, to belong to the nation, in consideration of a yearly subsidy from government to assist in carrying out its purposes during this interval.

"The second duty of experimental stations is to teach, or to convey to the people, the advantages deducible from study and experiment; to make possible the practical adaptation of the theoretical truth discovered.

"The third duty is to warn; to be the people's true knight, fighting off from them falsehood and trickery. In the one field of adulterated and worthless manures are sufficient opportunities for science to expose and defeat impostures.

"The locations of experimental stations is now the subject of much discussion. They were first established on isolated estates, generally remote from great cities, chiefly because scientific land owners offered the land and certain assistance to such enterprises. Now, however, the necessity for locating them near large cities, and in connection with academies and universities, is urged. The ground for such change is twofold: the necessity of full apparatus for experiment, and an increase of the staff of scientific workers. At isolated stations the investigations must be chiefly chemical, as a chemist is in charge, generally without allied workers in other departments of natural science, and the means for experiments are generally such as a chemical laboratory can furnish; but scientific agriculture calls for aid from mineralogy, geognosy, physics, physiology of plants, physiology of animals, &c. Such union of strength can at present only be reached for experimental stations when, by connection with academies or universities, they have the co-operation of the entire faculties of such institutions. If means were unlimited, agricultural stations, however isolated, might command such corps of workers; but while the investments for experimental stations are so small, only their union with institutions can sufficiently broaden their scope. Again, in isolated localities, only such students as make practical agricultural chemistry a specialty could turn aside to avail themselves of the advantages of such stations. Allied to institutions, the advantage is reciprocal; the station drawing strength from the faculty and apparatus of the institution, and the students of the high-school or university having access to all the records and participation in the experiments of the station. Considering the meager expenditure upon experimental stations, the results upon the agriculture of the country have been most remarkable. Within this decade they have cost, at highest, forty thousand thalers, hardly enough to maintain a company of soldiers for the same length of time; and yet with this paltry outlay they are expected to revolutionize the agriculture of Germany.

"More important than the place chosen for experimental stations is the working capital at their command. Only with a liberal outlay of money and time can liberal results be reached. Not lightly does nature allow man to wrest the seal from her treasury of secrets."

I remain, most truly, your obedient servant,

J. H. McCHESNEY.

Hon. HORACE CAPRON, *Commissioner.*

REPORT ON BEET SUGAR IN EUROPE.

SIR: In obedience to your request, I present a few statements showing the progress and condition of the beet-sugar enterprise in Europe, after personal investigation of the operations of each establishment.

The time when sugar first became known in Europe cannot be stated with any certainty, but the statements of various authors, such as Theophrastus, Plinius, Paulus Ægineta, and others, leave no doubt that cane juice, boiled to sirup, was known, and used as a medicine by the most ancient people. Still earlier, the art of making sugar appears to have been known by the Chinese, Alexander von Humboldt having seen Chinese paintings on porcelain of great age representing various methods of working sugar cane and extracting its juice. Asia undoubtedly is the mother country of sugar, whence it was first brought by the Turks to Cyprus, in the ninth and in the eleventh century; also to Rhodes, Sicily, and Crete, and probably all around the Mediterranean; thence by the crusaders, especially by the Venetians, to the more western countries. Later, perhaps in the fifteenth century, it found its way over Madeira and the Canary Islands to Brazil; and, in the sixteenth century, to the West India Islands. There is no doubt that the cultivation of sugar cane on a large scale was first introduced into America, and especially into the West Indies, by the Europeans.

The first importation of sugar into Europe which is particularly known was in the year 996, into Venice. In the year 1319 the Venetians brought a cargo of 100,000 pounds of sugar and 10,000 pounds of rock candy to London. The first sugar refinery on the continent of Europe was built in Augsburg, in the year 1573, by a man named Roth. Another was built in Dresden, in the year 1597. While in its early days sugar was found only in apothecaries' shops, and used as a medicine, it is counted now among the provisions, and has become a necessity second only to meat and flour.

The first discovery of beet sugar was made the 3d of March, 1747, by the Prussian chemist Margraaf, (Andrea Sigismund,) director of the philosophical section of the Academy of Science at Berlin, who read, at its general meeting, an essay, in which he proved the existence of cane sugar in many home-grown roots. He stated that the most sugar was to be found in the Silesian beet, produced samples, and specified the method by which he had obtained them, and proved it not only practicable, but remunerative, to produce beet sugar on a large scale. It will be borne in mind that this was during a time of war, when the ordinary means of transportation were interrupted and money for importations was scarce, in consequence of which sugar was high; but, as soon as peace was restored, sugar prices went down, and the great interest taken in producing it at home died out.

No sooner, however, had war commenced again, than the subject of beet sugar production was resumed. Shortly after 1790, Achard built on an estate (Cunern) in Silesia, which the King of Prussia had presented to him for the purpose, the first beet-sugar factory. In this factory he worked, supported by the Prussian government and under the observation of a government officer, 7,000 pounds of beets per day, from

which he obtained six per cent. of raw, or five per cent of white sugar. In November, 1799, Van Mons caused a letter to be published in the Annales de Chimie, written by Achard, in which he described the results obtained in his sugar works at Cunern. He states the cost price of raw sugar to be 5.4 cents per pound English, (65 *centimes** per *kilogram*,†) besides the beet pulp, beet leaves, and molasses; the former he used for fattening cattle, and the molasses for making alcohol.

These results caused a great sensation in France. All the newspapers republished them. The enormously high price which sugar commanded after France had abolished slavery in her colonies was the reason why the National Institute of France appointed a chemist of great celebrity to examine this new process and report upon it. M. Deyeux made his report in 1800, and, although he considered the advantages to be derived from beet-sugar industry overestimated, two experimental factories were established near Paris—one at St. Rouen, the other in the old abbey of Chelles. Neither of the two reached results which could be compared with those of Achard, and were, therefore, closed again, and for a long time were the laughing-stock of those who knew of them. Meantime, two new factories had been built in Germany, one by the Baron von Koppy, in Silesia, the other by the celebrated Mathusius, in Althaldensleben, near Magdeburg. The publicity given to the results obtained by the three German beet-sugar factories drew anew the attention of the French government to the subject, and new trials were made in 1810 by Deyeux and Derosne, and in 1811 by Barrud and Isnard, with the German method of extracting the sugar from the beet, and the result obtained proved more satisfactory. The war which devastated Germany during 1813, 1814, and 1815 left the country in an exhausted condition, from which it did not recover for many years. Industry in general was paralyzed, and no efforts were made to perfect the system of sugar-making. It was different, however, in France. The new impulse given to chemistry and engineering showed its effect on the sugar factories, which were considerably improved, one of the principal improvements being the use of animal charcoal. In 1828 one hundred and three factories were making beet sugar in France, producing three thousand three hundred tons of sugar, and during the year 1836–'37, fifty-five thousand tons; but, in consequence of a tax being levied on it, the production fell the following year to twenty-five thousand tons.

The beet-sugar production in Germany or in the Zollverein made little progress till 1836, but it has since reached such dimensions that it not only supplies the home demand, and prevents cane sugar from coming into competition, but has become a regular article of export, competing in the English and the Dutch markets with the sugar of the tropics. The table (A) shows the enormous dimensions which the beet-sugar industry has attained during the period between 1836 and 1867. Of the one hundred and twenty-two factories in operation in 1836, ninety belonged to Prussia and thirty-two to the various other states of the Zollverein. During the year 1866–'67 two hundred and ninety-six factories were engaged in making beet sugar, two hundred and fifty-seven of which were located in Prussia and its provinces, while only thirty-nine were in the other states of the Zollverein. The increase in the number of factories has been almost exclusively in Prussia, where its number was trebled during thirty-two years. The tax levied on beet sugar in 1840–'41, of 0.575 cents per *centner*‡ of green beets, diminished the whole number

* *Centime*, $0.00192. † *Kilogram*, 2.204737 pounds.

‡ *Centner*, (Prussian,) 113.44 pounds.

of working sugar-factories from one hundred and fifty-two to one hundred and forty-five; in 1842–'43 the tax was doubled, when the number was reduced to ninety-eight factories.

The small and poorly-constructed establishments could not compete with the new and larger ones, nor with the cane-sugar refineries, the proprietors of which strained every nerve to drive beet sugar out of the market, and the former, therefore, had to suspend work. Although, in 1843–'44, factories were at work again, the number was reduced to ninety-eight the next year, and to ninety-six in the following year, the tax having been again increased. Since 1846–'47 the production has taken a decided start, the number of factories having grown from year to year, and they emancipated themselves from the cane-sugar refineries by producing either molasses or white loaf-sugar direct from the beet juice, without first working it into raw sugar; so that when, in 1850–'51, the tax on beet sugar was again doubled, it did not prevent new factories from being built.

While the number of sugar factories increased, the quantity of the beet worked by the same increased in a far greater ratio. It must be taken into consideration that official figures have been kept only since 1840–'41, when records were commenced on account of the tax to be levied, and comparisons should be made only of years included in the official figures. Accordingly, the columns 2 and 3, table A, show that during the twenty-seven years from 1840–'41 to 1866–'67 the number of working factories increased from one hundred and forty-five to two hundred and ninety-six, making an increase of about one hundred and four per cent., while the quantity of beets worked in these factories increased from 4,829,734 cwts. (of one hundred pounds) to 50,712,709 cwts., making an increase of nine hundred and fifty per cent. Of course the quantity of beets worked by each factory must have increased in proportion, as may be seen by column 15, table A, according to which each factory worked, on an average, in 1836–'37, 4,155 cwts., or 227 English tons; in 1840–'41, 33,309; while in 1866–'67 the high average of 171,327 was reached. The variations in columns 3 and 15 of table A are the results of unfavorable beet crops. According to column 8, table A, the internal revenue or tax paid on the beets has increased from a quarter of a cent to seven and a half cents, or thirty-fold, while the actual revenue derived, as given in column 9, has increased from 40,248 thalers* to 12,678,177 thalers, or nearly three hundred and fifteen fold.

These averages are correct according to the best authorities, and go to show the enormous progress made not only in manufacturing beet sugar, but in cultivating and producing beets. It is obvious that the great variation in the average weather of the various years necessarily accounts for the variations of percentage of sugar and foreign matter in the beets, and the more or less difficult working of the same.

The systems of taxation in the different countries influence the general result in many particulars. In Prussia, or the Zollverein, the beets are washed and trimmed, and then weighed by government officials, and the revenue collected according to the quantity which enters the factory. From that moment the sugar manufacturer is at liberty to work at will, the government taking no notice, or at least not interfering, no matter how rich the beets, or how much or what kind of sugar is made; in fact, leaving him entirely free to do with the beets as he may please, except working them into alcohol.

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* A thaler is about 73 cents.

Table A.

In the year of	Number of actually working beet-sugar factories.	Quantity of green beets worked, the dried ones reduced to green beets.	Raw sugar produced, the refined reduced to raw.	Molasses produced for distilling purposes.	Beet pulp for fattening cattle.	Beet tops for fattening cattle.	Internal revenue paid to government in gold.		Quantity of beets required for one pound of sugar.	Yield of raw sugar.	Yield of molasses.	Percentage of beet pulp.	Percentage of beet tops.	Average per factory of beets worked.	Average of raw sugar produced.	Consumption per capita.
		Cwts. 110 lbs., English.	Cwts. 110 lbs., English.	Cwts.	Cwts.	Cwts.	Per ct.		Lbs.	Per ct.	Per ct.			Cwts.	Cwts.	Lbs.
1836-37	122	506, 923	28, 162	21, 798	119, 127	17, 712	......	....	18. 00	5. 50	4. 30	23. 50	3. 50	4, 155	231	3. 99
1837-38	156	2, 763, 912	153, 552	118, 850	649, 526	105, 030	......	....	18. 00	5. 50	4. 30	23. 50	3. 80	17, 712	984	3. 68
1838-39	159	2, 904, 208	163, 158	116, 168	679, 585	116, 168	......	....	17. 80	5. 62	4. 00	23. 40	4. 00	18, 266	1, 026	4. 74
1839-40	152	4, 405, 637	253, 198	167, 414	1, 026, 513	180, 631	......	....	17. 40	5. 75	3. 80	23. 30	4. 10	28, 984	1, 666	5. 10
1840-41	145	4, 829, 734	284, 102	178, 700	1, 120, 498	202, 849	. 58	$28, 173	17. 00	5. 88	3. 77	23. 20	4. 20	33, 309	1, 959	4. 69
1841-42	135	5, 131, 516	314, 817	179, 603	1, 180, 249	220, 655	1. 16	59, 797	16. 30	6. 13	3. 50	23. 00	4. 30	38, 011	2, 332	4. 64
1842-43	98	2, 475, 745	154, 734	81, 700	561, 994	111, 409	1. 16	28, 883	16. 00	6. 25	3. 30	22. 70	4. 50	25, 263	1, 579	4. 75
1843-44	105	4, 319, 667	286, 162	139, 189	969, 976	191, 385	1. 16	50, 745	15. 20	6. 58	3. 20	22. 30	4. 49	41, 125	2, 725	5. 03
1844-45	98	3, 890, 404	259, 360	124, 493	855, 889	178, 959	3. 50	136, 164	15. 00	6. 67	3. 70	22. 00	4. 60	39, 698	2, 647	5. 57
1845-46	96	4, 455, 092	303, 068	138, 108	966, 755	200, 479	3. 50	155, 918	14. 70	6. 80	3. 10	21. 70	4. 50	46, 407	3, 157	5. 60
1846-47	107	5, 633, 818	402, 418	169, 015	1, 205, 643	264, 970	3. 50	197, 184	14. 00	7. 14	3. 00	21. 40	4. 70	52, 653	3, 761	5. 13
1847-48	127	7, 676, 772	536, 837	230, 303	1, 612, 122	345, 455	3. 50	268, 687	14. 30	7. 00	3. 00	21. 00	4. 50	60, 417	4, 227	5. 84
1848-49	145	9, 896, 718	717, 154	287, 005	2, 058, 517	455, 249	3. 50	346, 385	13. 80	7. 27	2. 90	20. 80	4. 60	68, 253	4, 946	6. 00
1849-50	148	11, 525, 671	847, 475	322, 719	2, 362, 763	553, 232	3. 50	403, 398	13. 60	7. 35	2. 80	20. 50	4. 80	77, 876	5, 726	6. 01
1850-51	184	14, 724, 309	1, 066, 979	397, 556	2, 989, 035	736, 215	7. 00	1, 030, 701	13. 80	7. 25	2. 70	20. 30	5. 00	80, 023	5, 799	6. 01
1851-52	234	18, 289, 901	1, 261, 372	512, 117	3, 694, 560	951, 075	7. 00	1, 280, 293	14. 50	6. 90	2. 80	20. 20	5. 20	78, 162	5, 390	6. 00
1852-53	238	21, 717, 096	1, 696, 648	542, 927	4, 343, 419	1, 194, 440	7. 00	1. 520, 197	12. 80	7. 81	2. 50	20. 00	5. 50	91, 249	7, 128	7. 42
1853-54	227	18, 469, 890	1, 420, 761	443, 277	3, 657, 038	1, 081, 814	14. 00	2, 585, 784	13. 00	7. 70	2. 40	19. 80	5. 60	81, 365	6, 259	6. 97
1854-55	222	19, 188, 402	1, 572, 820	441, 335	3, 780, 115	1, 055, 362	14. 00	2, 686, 376	12. 20	8. 20	2. 30	19. 70	5. 50	86, 434	7, 085	6. 31
1855-56	216	21, 839, 799	1, 747, 184	513, 235	4, 280, 601	1, 223, 029	14. 00	3, 057, 572	12. 50	8. 00	2. 35	19. 60	5. 60	101, 110	8, 089	7. 10
1856-57	233	27, 551, 208	2, 071, 519	633, 678	5, 372, 486	1, 597, 970	14. 00	3, 857, 169	13. 30	7. 52	2. 30	19. 50	5. 80	118, 246	8, 891	7. 02
1857-58	249	28, 915, 134	2, 409, 594	636, 133	5, 609, 536	1, 734, 908	14. 00	4, 148, 118	12. 00	8. 33	2. 20	19. 40	6. 00	116, 125	9, 677	7. 65
1858-59	257	36, 668, 557	2, 887, 288	843, 377	7, 077, 032	2, 273, 451	17. 50	6, 416, 997	12. 70	7. 87	2. 30	19. 30	6. 20	142, 679	11, 235	9. 16
1859-60	256	34, 399, 317	2, 915, 196	756, 785	6, 604, 669	2, 167, 157	17. 50	6, 019, 880	11. 80	8. 47	2. 20	19. 20	6. 30	134, 372	11, 3[illegible]	9. 58
1860-61	247	29, 351, 032	2, 530, 520	631. 112	5, 606, 620	1, 878, 658	17. 50	5, 136, 955	11. 60	8. 62	2. 15	19. 10	6. 40	118, 842	10, 245	8. 32
1861-62	247	31, 692, 394	2, 515, 296	713, 079	6, 021, 555	2, 060, 006	17. 50	5, 546, 169	12. 60	7. 94	2. 25	19. 00	6. 50	128, 309	10, 183	7. 85
1862-63	247	36, 719, 259	2, 760, 847	789, 464	6, 939, 940	2, 386, 752	17. 50	6, 425, 870	13. 30	7. 52	2. 15	18. 90	6. 50	148, 661	11, 178	8. 61
1863-64	253	39, 911, 520	3, 023, 600	898, 009	7, 503, 366	2, 634, 160	17. 50	6, 984, 516	13. 20	7. 58	2. 25	18. 80	6. 60	157, 753	11, 951	9. 01
1864-65	270	41, 641, 204	3, 413, 214	978, 568	7, 870, 188	2, 665, 037	17. 50	7, 287, 210	12. 20	8. 20	2. 35	18. 90	6. 40	154, 227	12, 642	9. 37
1865-66	295	43, 452, 773	3, 713, 912	1, 173, 225	8, 256, 027	2, 650, 619	17. 50	7, 604, 235	11. 70	8. 55	2. 70	19. 00	6. 10	147, 298	12, 589	10. 69
1866-67	296	50, 712, 709	4, 024, 818	1, 242, 461	9, 736, 840	3, 397, 752	17. 50	8, 874, 724	12. 60	7. 94	2. 45	19. 20	6. 70	171, 327	13, 597	9. 00

In France the government begins its control as soon as the beet juice is extracted, weighing its specific gravity in the clarifying pan, and from that moment keeps a continual supervision of the whole process of sugar making, until the sugar leaves the entrepot or bonded warehouse, and enters into consumption. The annoyances incidental to this system are innumerable and continuous.

In Austria the system of taxation is regulated according to the different methods of extracting the juice, and the capacity of the machines employed for the purpose. The quantity of beets which could be worked with each machine for extracting juice is computed for twenty-four hours, and "lumped," which is called "pauschaling." The government keeps no other control than noting the number of hydraulic presses or other machines which work each day, according to their rating, allowing for no stoppages, unless a machine stops at least twenty-six hours. This system of taxation bears unevenly upon different factories, and is the cause of the secrecy observed in some of them as to general results.

In Russia, when new factories are built, they work for a certain time on trial, under the control of government officials, after which a quantity is agreed upon, which the factory works in twenty-four hours, and the amount of revenue which it ought to pay accordingly. Otherwise the government takes no notice of what is produced in any factory, and no official records are kept.

In Belgium the system is like that of France in nearly every respect, and in Poland it is the same as in Russia.

The influence of these different systems of taxation on the management of sugar works, and even on the culture of the beet, is surprising. In the Zollverein, where eighteen cents must be paid to the government for every *centner* of beets worked, a great deal of attention is paid to the production of rich beets, by reason of which the quality has been steadily improving. Beets are seldom raised on newly manured land; as a general rule the manure is applied to a grain crop, as barley, wheat, or rye; after these crops are taken off beets are raised without any manure, and after beets such crops, according to the strength of the land, as will pay best. Beets are, therefore, raised in rotation, on an average once in four years. The system of manuring and of producing the manure has not only been studied as a science, but is practiced as an art. If it can be said of any country that the more beets and beet sugar it produces, the more grain it will yield, it can be said of the Zollverein; and it is much to be regretted that we have not so complete and correct official statistics of the increase of grain as we have of sugar. As the production of sugar has nothing to do with the amount of revenue, there is no objection to giving correct figures, either to the government or to individuals; and the manufacturers are left entirely free to work with any kind of machinery, in any way they please, to change it at will, and to make as many experiments as they like. The part to which sugar manufacturers pay most attention in the course of the work, whether they raise the beets or buy them, is to have the beet as rich in sugar as possible, and to take out all the juice that can possibly be expressed; the revenue tax being the same, whether seventy-five per cent. or ninety per cent. of the juice is extracted, and whether the juice contains ten per cent. or fifteen per cent. of sugar. It cannot be denied, therefore, that the system followed in the Zollverein is the most scientific and the most rational of any, and the official figures obtained in relation to it the most reliable.

In France government supervision commences with the extraction of the juice; the raw beets being under no control, and the quality being

considered immaterial, they are not near so rich as those grown in the Zollverein, and are mostly raised on newly manured land, the great aim being to produce a large crop, or, in other words, to raise as many beets on an acre as possible. As a natural consequence, grain crops are not so large as they might be, the limit of manure production being always the natural limit of fertility. Statistics, with the exception of the actual sugar production and consumption, are less reliable and complete than those of the Zollverein, the tax in Austria being varied on the number of juice-producing machines, and their capacity according to official classification. A press, or other juice-rendering machine, can work as many beets of rich quality as of inferior; and, as the tax is the same of either, it is essential to work as rich beets as possible; therefore, the beets raised there are generally of a quality superior to those in France. The juice is never so perfectly extracted as in the Zollverein, although double pressing is never resorted to.

In Russia, where the sugar factories work on trial, under government supervisors, for a short time only, and are taxed according to the result obtained, no statistics can be procured, or, if so, they are unreliable; but it is estimated that Russian factories work twice the amount reached by government taxation.

It is obvious that the figures given by the revenue officers of the Zollverein are the most complete, and the most reliable, and that the method of working in the factories is the most rational, because it opens the way for improvement, and every method of working is judged by its own merits, as no outside matters need be considered.

During the season of 1867–'68, there were three hundred beet-sugar factories in operation in the Zollverein; in France, four hundred and seventy-one; in Belgium, one hundred and eleven; in Holland, eighteen; in Austria, one hundred and thirty-eight; in Russia, four hundred and thirty-nine, (of these one hundred and twenty-nine were not in operation;) in Poland, forty; in Sweden, one; and in the United States, one. The number of all known beet-sugar factories in the world is thirteen hundred and ninety.* The quantity of beet sugar produced amounted in 1828 to 7,700 tons; in 1851 to 192,500 tons, and in 1865 to 581,350 tons. In France 17,000,000 *hectares* † of land are required in beet culture to keep the factories employed, which is about one-sixth of all her land fit for cultivation; the same proportions applying to Belgium and Holland.

The government estimates are that in the Zollverein the average quantity of raw sugar obtained from beets during the season of 1845–'46 was five per cent.; from that time to 1854–'55, six and two-thirds per cent.; and since that time eight per cent.; or, in other words, up to 1845 it required a ton of beets to produce one hundred pounds of sugar; from 1846 to 1854 it required three-fourths of a ton of beets to one hundred pounds of sugar, and since then five-eighths of a ton to one hundred pounds of sugar. The increased product is partly due to improved machinery, and partly to the improved quality of the beets raised.

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* The recent report of W. Wadsworth, agent of the Sacramento Beet Sugar Company of California, states that "the number of beet-sugar factories in the different countries of Europe is as follows: France, three hundred and sixty-four; Belgium, thirty-six; Prussia, one hundred and forty-six; Austria, one hundred and twenty-five; in the rest of Germany, forty-eight; Poland, thirty-one; and in Russia, four hundred and forty-one; making in all one thousand one hundred and ninety-one without counting those smaller concerns that are found here and there in very many of the smaller isolated agricultural districts, and distinguished from the larger factories by their motive power being the animals of the farm, and their cost, generally, not exceeding five thousand dollars. If, however, these are counted in, there are then over six hundred beet-sugar factories in France alone, all of which are visited regularly by government officials, who collect the duties imposed on the sugar produced."—Ed. Report.

† *Hectare*, 2.4711 acres.

In Germany and France it was formerly easy for sugar manufacturers to procure supplies of the beet, and the business was looked upon as a purely manufacturing one; but of late years many factories have been compelled to discontinue work, because it is impossible to procure beets. These factories are mostly located near large cities, where farmers brought their beets. Sugar production is now considered an agricultural business, and no factories have been built of late without sufficient land at command.

The local institutions of different countries, especially as relating to the divisions and ownership of lands, greatly affect the establishment and prosperity of beet-sugar works. In Russia, of all the sugar factories forty-five per cent. belong to the nobility, and fifty-five per cent. to large landed proprietors, no joint stock companies existing. In Austria only thirty-eight per cent. are in the hands of the nobility; thirty-six per cent. in those of land proprietors, and there are twenty-six joint stock companies. In France the greater portion of these establishments belongs to private partnerships. In the Zollverein sixty-five cent. belong either to private parties or to private partnerships, while fifty-five per cent. are joint stock companies. Both in France and the Zollverein the sugar works owned by the nobility are few in number, probably not five per cent. of the whole. The prosperity of these establishments, and their progress in perfecting the method of manufacturing, are in reverse proportion as they are owned by the nobility; Zollverein, Austria, and France having, perhaps, equal chances for progress during the last fifteen years.

The capacity of the largest beet-sugar factory known is sixty-six thousand tons per annum. It is located in Waghäusel, grand duchy of Baden, and works the beets complete into white loaf sugar. One of the smallest has a capacity of nineteen hundred tons per annum, and is located at Klehtendorf, in Silesia; the former working summer and winter; the latter only in winter.

Looking back forty years, it is surprising to see the regular and steady increase of sugar consumption. From an article of luxury or medicine it has become a necessity of every-day consumption. Every civilized country has exerted itself to secure emancipation from slave-grown cane sugar, and to stop the flow of money to a few colonies. Without the United States as a regular customer, Cuba and Brazil might as well give up growing sugar, and direct their attention to a more healthy occupation.

The United States is among the largest sugar-consuming and importing nations in the world, while producing little; and whatever can be said of other nations, regarding the necessity of becoming independent as to their supply of sugar, applies with greater force to this country. In 1840 the consumption of sugar in the Zollverein amounted per capita to 4.67 pounds; in 1866 it amounted to 10 pounds per head, an increase of over one hundred per cent. in twenty-five years. In 1840 the quantity of sugar consumed in Austria was 1.68 pounds per head; in 1862 it reached 5.1 pounds, or nearly three hundred per cent. increase. As the consumption of sugar keeps pace with a nation's prosperity and progress in civilization, is there any reason to doubt that the consumption of sugar in the United States will increase in a ratio at least equal to that in Austria and the Zollverein.

THE MANUFACTURE OF BEET-SUGAR.

The operation of manufacturing beet sugar may be divided into three distinct parts: 1, the extraction of juice; 2, the purification of the same;

and 3, reducing the purified juice to crystals. The principles on which the different establishments work are everywhere the same; but the means employed to reach the same end vary considerably. The mode of extracting the juice varies more than anything else, the great aim being to obtain the greatest possible quantity with the least foreign matter. Beets contain, besides fiber, sugar and water, vegetable albumen, organic acids and alkalies, in combination with organic and inorganic acids.

The extraction of juice is done by the following process: hydraulic presses, centrifugal machines, green maceration, dry maceration, and diffusion. To these five methods may be added the system of double-pressing with hydraulic presses, and centrifugal machines in combination with hydraulic presses. These different methods are in regular practical use; others have been employed by way of experiment. They are all old, with the exception of "diffusion;" all have their advantages, and all are open to objections. The use of hydraulic presses is the most extended, and probably three-fourths of all the sugar made has passed through the press process.

In the early history of beet sugar it was considered essential to add sulphuric acid, to prevent the juice from deteriorating, but this system was discarded long ago, giving place to the opposite principle. The juice, after its extraction, is clarified with lime, in which great progress has been made. In the early days of beet-sugar manufacture, after the addition of acids was discontinued, lime was employed in limited quantities to purify the beet juice, from one-half to three-fourths of one per cent., beginning with the opening of the season at the lower figure, working up to the higher as the season advanced and the beets deteriorated. With improved machinery, however, lime is employed almost without limit; and it is not uncommon to use three per cent. of lime In purifying beet juice three distinct processes are in use, although in each the agent used is heat in combination with lime. These processes are mostly named after their inventors. The oldest and simplest process, and which is still found in many sugar-works, is the simple heating of beet juice to about one hundred and sixty-five degrees, adding, at that temperature, one-half to three-fourths per cent. of newly slaked lime, and raising the heat, as fast as possible, to the boiling point. The action of lime and heat coagulates the vegetable albumen, and changes many of the organic combinations. Lime and impurities form a heavy, tough scum, which covers the surface, while the bright and clear juice can be drawn from under it. This bright juice, mixed with other foreign matter, contains considerable lime in solution. In former years animal bone coal was the only ingredient employed to separate the lime from the juice. Many factories may be found, up to this day, which work by this simple process; but the greatest number employ carbonic acid to precipitate the lime, in the form of carbonate of lime. The carbonic acid employed for that purpose is generated simply by the burning of coke, drawn into the juice by a mixture of carbonic acid and carbonic oxide gas, the former combining with the lime, and forming a carbonate, the latter passing through the juice without any effect.

Another and newer method was invented by Frey and Ielirick, and consists in beginning the carbonization as soon as the juice runs into the pan, the slaked lime being placed in the pan before the juice enters. Three per cent., or sometimes more, of lime is employed by this process, which is, no doubt, most advantageous when working inferior or deteriorated beets. A third process is the one by Perier and Pozzos, who repeat the treatment of beet juice with lime and carbonic acid several

times, aiming at the saving of a greater part of animal charcoal. When large quantities of lime are employed, as in the Frey and Ielirick process, and the Perier and Pozzos, the carbonic acid is obtained from the burning of limestone in limekilns, built expressly for the purpose. All these different methods have their advantages, and all are open to objections. No one method is adopted in any locality, nor is it possible to say which is the best. It generally, and with rare exceptions, depends upon local matters. If lime is not easily obtained, or is impure, it is used more sparingly; if bone-black can be cheaply procured, the employment of carbonic acid is not so essential; the question of fuel is an item in the calculations.

The reason why it is impossible to agree upon any one method of working is the variation in the quality of the beets in different years, as well as in the beets grown the same year in different soils and weather. Factories may be found belonging to one owner, working according to different systems, and so operating for years without solving the problem as to which is the best method under any or all circumstances. Only by the statistical tables can the steady advance and progress be observed.

In comparing the different systems and methods of working in the beet-sugar manufactories of Europe, with a view of finding the best for the United States, it is necessary to examine the circumstances under which they work. It will be observed on page 170, which gives a specified account of a whole season's work, as it has taken place, that the internal revenue is the highest item of expense—even higher than the whole cost of the raw beet. Fuel and wages, each amounts to only one-third of either the internal revenue or the cost of beets, while the interest and discount are figured lower than either fuel or wages. Where land is expensive and difficult to be procured, beets will always command a high price, and the longer the season the higher will be the price of beets. Fuel will always be in proportion to the number of working days, making it immaterial whether the work is extended over the whole season or only over a part. Wages are extremely low already, and they cannot be expected to change much if the working season is extended. The interest and discount would be changed but little if a working season were extended from one hundred and twenty to two hundred and forty days or more, while all the advantages to be gained might be more than counterbalanced by the increased price of beets.

It is readily understood, therefore, why the sugar manufactories lay so little stress on working the whole year. Attempts to do so have been made, and a few establishments are still at work with dry beets; but they do not find many followers. When the process of drying beets and working them the whole year was suggested and put into execution, it was with a view of obtaining the juice in a pure state. By drying the sliced beet and exposing it to a temperature of boiling water, the vegetable albumen contained in the beet coagulates, and becomes insoluble in water; but still the juice obtained is no purer—other changes taking place. The hope of obtaining a better juice thereby has not been realized, and the advantage of working the whole year has been counterbalanced by several disadvantages: one, and not the least, being the worthlessness of the refuse as feed for stock. The dry beet being treated with lime, retains large portions of it, which makes it unfit for use. The fuel consumed makes a heavy item of expense, and is not counterbalanced by the saving of interest on the investment or anything else.

A third objection is the tax. Wherever there is any doubt, the revenue bureau construes in its own favor. Formerly one ton of dried beets was

counted an equivalent for four and three-quarters tons of green or fresh beets, but the proportion is now two to one in calculating the taxes. This proportion may be correct, when beets are perfectly dry, and of inferior quality when fresh; but very rich beets will not require five tons to produce one of dried ones. It is, therefore, more advantageous to work dry beets in bad seasons than in good ones. In a very wet season, and where dry beets have to be transported a great distance, they absorb a great deal of water, which is weighed with, and counted for, beets, and has to pay revenue. But the greatest difficulty is to procure land enough in the vicinity for growing beets, and to produce manure enough to keep the land in its strength.

The principal objections to the system of working the whole year either dried beets continuously, or fresh beets in fall and winter, and dried in spring and summer, may be stated as follows: Scarcity of land; the oppressive system of taxation; high price of land compared with the low price of labor; impossibility of producing manure to keep up the productiveness of the land, if the refuse of the beet cannot be used for cattle-feed, and the low price of capital invested in sugar works.

Not one of all these objections would apply to sugar works, and the system of working dried beets in the United States. Land is neither scarce nor high in price; taxation, if resorted to, would not be oppressive; fuel is very low, while labor is proportionally high; cattle-feed can readily be produced, when farmers see the absolute necessity of a regular system of manure production; and finally the price which capital commands is, at least, double that of any European country.

The process of obtaining the beet juice by "diffusion" is almost the same, whether applied to green beets or to dried. The machinery is the same and can be used for either, and the actual labor to be performed in extracting the juice is considerably less, and in character less objectionable. A factory working by this system in the juice-rendering process thirty-five and three-fifths tons every ten hours, employs eighteen men. A factory rendering the juice by pressing with hydraulic presses (singly) requires forty-two men; working with centrifugal machines, nineteen men; with green maceration, eighteen men; with double hydraulic presses, twenty-five men; while a factory working with centrifugal machines, and pressing afterwards with hydraulic machines, requires forty-one men. The excess of hand labor, required in the press process, cannot be said to be counterbalanced by a juice obtained of one to one and a half degree more density.

The annexed tables give the complete figures taken from the books of the various establishments, and the question is natural, if sugar can be produced at those figures in nearly every country in Europe, why has the largest sugar-consuming nation in the world to rely on its supply from abroad? Why has not beet sugar long ago been produced in the United States?

The system of farming, if the agricultural labor in the United States can be so designated, has been different from that of any other country, and, with rare exceptions, has never paid; hence, the first requirement for beet-sugar industry, well-cultivated land, cannot be readily obtained. Deep or thorough cultivation is but little known, and money, as an investment in farming, has seldom proved remunerative. But the same causes will ultimately produce the same effects; in order to make our lands as productive as they ought to be, a rotation of grain and root crops will have to be resorted to. As soon as a regular rotation of crops is introduced into the United States, farming, as such, will pay,

and the raw material for beet-sugar factories can be readily produced; until then sugar works will have to do their own farming. When beet sugar was first manufactured in Europe there was no difficulty in procuring the raw material, and all efforts to produce sugar could, therefore, be directed toward the working of beets, not to their production.

Comparatively little has been done in the United States to pave the way for sugar production. While in Europe, Henry Clay took great interest in the beet-sugar production of France; and, in speeches made in Congress, he predicted great results from its introduction. More than twenty-five years ago the first effort to introduce this branch of industry into the United States was made, but there exists no authentic record of the results obtained. There is nothing to indicate what variety of beet was raised; the quantity obtained from a given area of land; what percentage of sugar, and what percentage of foreign matter these beets contained; the kind of soil they were raised in, or how the season compared, in respect to temperature and rain-fall, with an average one. Hence the experiment in Northampton, Massachusetts, costly as it may have been, has not benefited anybody, nor advanced beet production.

Since then numbers of experiments have been made to raise sugar beets by private parties; but no regular systems were adopted, and all being detached, we are as much in the dark to-day as to what beets to raise, and how and in what locality to raise them, as we were twenty-five years ago. In May, 1867, the Agricultural Department at Washington sent nine different varieties of beet seeds to Chatsworth, Illinois, for trial and comparison with the beets produced in countries where they are grown for sugar production. The following are the results obtained, compared with the beets used for sugar making in several establishments, from the books of which we have been kindly furnished with extracts:

	Specific gravity of juice.	Polarization of sugar.	Foreign matter.
No. 1	14.75	11.90	2.85
No. 2	13.00	10.95	2.05
No. 3	14.25	12.59	1.66
No. 4	14.25	12.21	2.04
No. 5	13.50	11.57	1.93
No. 6	15.62	13.52	2.10
No. 7	14.12	11.98	2.14
No. 8	15.87	13.67	2.20
No. 9	15.12	13.25	1.87
Average	14.50	12.40	2.09
Average polarization in Einbeck Factory, working by the diffusion system		11.42	
Of 310 polarizations made during the season 1866–'67, at Breistedt Factory, working with hydraulic presses		11.09	2.26
Of 122 polarizations, same factory, 1867–'68		12.05	2.30
Of the season 1862–'63, at sugar factory, working with hydraulic presses		11.21	1.68

These figures, taken from the records kept by factories during the working season, show conclusively that the average quality of those nine varieties of the beet, raised from seeds furnished by the Department, was superior, but it remains to be proved what particular variety is best adapted to culture in the United States, and also which is the best locality for raising beets and producing sugar from them.

The following figures are taken from a report made by Dr. Grouven, chief of the experimental station (Versuchs Station) in Salzmünde, on his researches in tracing the influence of manure, soil, and weather on the quality and quantity of crops. These researches were conducted with

the greatest care, at an enormous expense, and with a most efficient staff of assistants; many estates volunteered their co-operation. The average of beet juice from twelve estates, each fertilized with different manure, showed the following percentage of sugar in the juice: Estate Tillan, 12.26; Vrerau, 12.80; Honingen, 13.21; Sudenburg, 9.29; Jakowa, 11.70; Grutzka, 12.10; Chakowitz, 13.49; Stifterhof, 12.70; Rhineschauz, 12.60; Junngersdorf, 12.84; Roszla, 11.52; Salzmünde, 14.78; average, 12.44.

The nine varieties of the beet, according to the foregoing statement, show an average of 12.40 per cent. of sugar in the juice, while the average of twelve experimental estates, where beets were raised with the greatest care, show an average of 12.44 per cent., or very nearly the same, which would seem to settle the question as to whether beets raised in the United States are as rich in sugar as those grown in Europe.

The lands upon which these beets were raised are as different in geological formation and physical condition as lands can be, which proves that it does not require a peculiar soil to produce beets. As a general rule, soil which is well adapted for producing barley is suited to beet culture. The soil on estate Tillan is light-colored, sandy loam, with very sandy subsoil, almost clear sand; estate Vrerau, sandy loam, containing about twenty per cent. sand, which increases in the subsoil as one goes deeper into it; estate Honingen, tough loam, with a subsoil from two to four feet, the same as the top soil, but further down more mixed with sand; estate Sudenburg, near Magdeburg, mild loamy top soil, with a subsoil more tough, which prevents the moisture from leaving the top soil too freely; estates Jakowa and Grutzka, top soil a black, mellow loam, two feet or more deep, with a subsoil, four feet deep, of yellow loam rich with lime; estate Chakowitz, in Bohemia, heavy clay soil, two and a half feet deep; it is a black soil containing considerable lime, otherwise would make good bricks, subsoil four feet, yellow loam; estate Stifterhof, in Southern Germany, top soil sandy marl, active and dry, three and a half feet; the subsoil is tough clay, almost impenetrable by water; island of Rhineschauz, a sandy loam top soil, little cohesive and easily worked, with a subsoil, the deeper the sandier; estate Junngersdorf, mild, very productive, loamy top soil, four feet deep, with a subsoil containing marl, with thirty per cent. carbonate of lime; estate Roszla, near the Harz Mountains, red, tolerably heavy loam on top, with a subsoil of heavy loam throughout; estate Salzmünde, a very mild loam, rich in lime down eighteen inches, of a dark humus color, with yellowish white subsoil, at least ten feet deep, containing still more lime, so that it might almost be called marl.

In cultivating the land great attention is paid to subsoiling. Without bringing the subsoil on the top, it is thoroughly stirred to enable it to absorb air and warmth, to carry water off more freely in wet seasons, and to keep more moisture in dry seasons. This system of working the soil so deep is the chief reason why the grain crops in beet-sugar districts are so much larger and less variable than in other places. The beet crops in Europe are considered as certain and safe as any other, but not more so; for the variations, both in quality and quantity, are the same as in grain or other root crops.

The following statements will show the workings of different factories, their productiveness, and the least cost of producing the sugar ready for market:

The practical working of the beet-sugar works, Jerxheim, during the season of 1867-'68, is as follows: This establishment is owned by a joint stock company, every shareholder being under obligation to raise or procure a certain quantity of beets annually; hence every stockholder is

a farmer. The establishment is one of the best conducted and best paying in the Zollverein. The annexed figures are taken from the books of the company: Total quantity of beets worked from the 1st of October, 1867, till the 16th of February, 1868, 10,725 tons; average quantity of beets worked per day, 88 tons; number of centrifugal machines employed to extract the juice, 12; number of tons worked with one centrifugal machine each day, 7½. The quality of the beets during the whole season is shown by the polarization of the juice, as follows:

Date.	Sugar in juice.	Foreign matter.
	Per cent.	*Per cent.*
October 1 to October 6, 1867	11.92	2.85
October 7 to October 13, 1867	12.15	[illegible]
October 14 to October 20, 1867	11.91	2.74
October 21 to October 27, 1867	12.15	2.62
October 28 to November 3, 1867	11.50	2.59
November 4 to November 10, 1867	11.35	2.36
November 11 to November 17, 1867	11.83	2.64
November 18 to November 24, 1867	11.83	2.54
November 25 to December 1, 1867	11.08	2.55
December 2 to December 8, 1867	10.57	2.47
December 9 to December 15, 1867	[illegible]	2.45
December 16 to December 22, 1867	10.95	2.45
December 23, 1867, to January 4, 1868	10.90	2.37
January 5 to January 11, 1868	10.79	2.29
January 12 to January 18, 1868	10.55	2.11
January 19 to January 25, 1868	[illegible]	1.97
January 26 to February 2, 1868	10.53	2.04
February 3 to February 9, 1868	10.49	1.98
February 10 to February 16, 1868	[illegible]	2.00
Whole season's average	11.17	2.43

The sugar and molasses obtained from the juice during the whole season amounted to 11.84 per cent. Of this yield 2,431,900 pounds of sugar were produced and brought into the market in the following quantities: first product, 6.21 per cent.; second product, 1.72 per cent.; third product, 0.59 per cent.; fourth product, 0.28 per cent. The total expenses for running the works the whole year of 1867–'68, and working 10,725 tons of beets, were per ton of beets, $3 31; internal revenue, $3 39; fuel, including factory and horses for workmen, 68 cents; wood and coal for blacksmith, 0.9 cents; coke for limekilns, 2.3 cents; wages, (total,) summer and winter, $1 05.5; bone-black, 5.4 cents; limestone, 4.9 cents; cooperage, 11 cents; paper for lining barrels, 2.1 cents; discount and interest, 16 cents; cartage of sugar, 11½ cents; repairs on machinery and building, 55.6 cents; salary, 18.1 cents; gas coal, 0.8 cent; oil, 1.7 cent; commission for selling sugar, 6.8 cents; insurance, 6.1 cents; sinking fund, 2.7 cents; sundries, 46.3 cents; total expenses for one ton of beets, worked, $10 39.

According to the foregoing account the yield of raw sugar was 8.8 per cent., or 176 pounds of sugar to each ton of beets, the 10,725 tons worked yielding 188,760 pounds of sugar. The total receipts for sugar and molasses amounted to $140,678 30. The cost of production was 5.9 cents per pound in gold, making a total of $101,368 40 for the aggregate production of the season, and leaving a net profit of $39,309 90.

The number of workmen employed ranged from 207 to 210, including men, women, and children, being 110 for day and 100 for night work. Wages were paid at the following rates: For carrying beets: 1 man, at 31½ cents, and 5 at 30¼ cents, $1 83¼; the same for night work. For centrifugal machine: 1 man, at 37½ cents; same for night. For topping and trimming beets: 12 girls, at 19 cents, $2 28; same for night. For

internal revenue scale: 1 man, at 35 cents; same for night. For grating beets: 4 boys, at 19 cents, 76 cents; same for night. For pulp wagon: 2 boys, at 21 cents, 42 cents; same for night. For centrifugal machine liquoring: 4 men, at 28 cents, $1 12; same for night. For taking out the pulp: 4 men, at 26 cents, $1 04; same for night. For carrying the pulp away: 2 men, at 26 cents, 52 cents; same for night. For starting centrifugal machine: 2 boys, at 23 cents, 46 cents; same for night. For juice gutter: 2 boys, at 23 cents, 46 cents; same for night. For first carbonizing juice: 1 man, at 37½ cents, 1 at 30½ cents, 1 at 28 cents, and 1 at 46½ cents, $1 42½; same for night. For scum presses: 1 man, at 31½ cents, and 2 at 29½ cents, 90½ cents; same for night. For steam syphon: 1 man, at 28 cents, and 1 at 25 cents, 53 cents; same for night. For second carbonizing juice: 1 man, at 30 cents, 1 at 29 cents, and 1 at 25 cents, 84 cents; same for night. For bone-black filter: 1 man, at 35 cents, and 2 at 25½ cents, 86 cents. Same for night. For Roberts's apparatus: 1 man, at 37½ cents; same for night. For sugar floors: 1 man, at 42 cents, 1 at 37½ cents, 9 at 35 cents, and 1 boy at 25 cents, $4 19½; none on at night. For limekiln: 1 man, at 35 cents, and 1 at 30 cents, 65 cents; for night, 1 man, at 35 cents. For lime station: 1 man, at 30 cents, and 1 at 26 cents, 56 cents; same for night. For washing wire cloth: 2 girls, at 22 cents, 44 cents; same for night. For engineers: 1 man, at 37½ cents, and 1 at 35 cents, 72½ cents; for night, 1 man, at 35 cents, and 1 at 32 cents, 67 cents. For firemen: 1 man at 37½ cents, 2 at 35 cents, and 1 at 28 cents, $1 35½; for night, 1 man, at 37½ cents, and 2 at 35 cents, $1 07½. For carting coal: 3 men, at 32½ cents, 97½ cents; same for night. For fermenting bone-black: 1 man, at 37½ cents, 6 at 32½ cents, and 3 at 30 cents, $3 22½; same for night. For drying bone-black: 1 man, at 32½ cents, and 1 boy at 25 cents, 57½ cents; same for night. For bone-black furnace: 2 men, at 31½ cents, 63 cents; same for night. For gas furnace: 1 man, at 37½ cents; same for night. For mechanics, &c.: 1 coppersmith, 47 cents; carpenter, 44 cents; blacksmith, 43 cents; blacksmith, 32 cents; harness-maker, 37½ cents; wire-cloth-maker, 32 cents; nurse for hospital, 35 cents; housekeeper, 35 cents; porter, 35 cents, $3 40½. For yard hands: 1 man, at 41 cents, 3 at 35 cents, 3 at 28 cents, 3 at 25 cents, and 7 boys at 21 cents, $4 52. The beet-sugar works in the province of Saxony and the duchy of Anhalt number as follows:

During what year.	Total No. of factories.	By hydraulic presses.	By maceration.	By centrifugal machines.	By diffusion.
1861–'62	149	130	12	7	—
1862–'63	151	132	12	7	—
1863–'64	157	138	12	7	—
1864–'65	165	150	9	6	—
1865–'66	178	161	9	6	2
1866–'67	176	159	9	6	2

THEODORE GENNERT.

Hon. H. CAPRON, *Commissioner.*

REPORT UPON THE AGRICULTURAL RESOURCES OF ALASKA.

SIR: Alaska may be divided agriculturally into three districts, each differing from the others in its climate, vegetation, and physical characteristics.

The first and most northern district, which I have termed the Youkon Territory, is bounded on the south by the Alaskan Mountains, on the east by the British boundary line, and on the north and west by the Arctic Ocean and Behring Sea.

The second or middle district, which might be called the Aleutian district, includes that part of the peninsula of Aliaska, and all the islands, west of the one hundred and fifty-fifth degree of longitude.

The third or southernmost, which may be named the Sitkan district, includes all of our possessions on the mainland and islands south and east of the peninsula of Aliaska.

THE YOUKON TERRITORY.

Surface.—The character of the country in the vicinity of the Youkon River varies from rolling and somewhat rocky hills, generally low, that is, from five hundred to fifteen hundred feet, and easy of ascent, to broad and marshy plains, extending for miles on either side of the river near the mouth. There are, of course, no roads except an occasional trail, hardly noticeable except to a voyageur. The Youkon and its tributaries form the great highway of the country. This stream—the Missouri, as the Mackenzie is the Mississippi, of the northwest—is navigable in our territory throughout for vessels drawing not over four feet of water, and for many hundred miles for boats needing much more than that. The smaller rivers are not so deep, but many of them may be navigable for considerable distances. There are no high mountains, properly so called.

Soil.—The underlying rocks in great part are azoic, being conglomerate, syenite and quartzite. The south shore of Norton Sound, and portions of the Kaviak Peninsula, are basalt and lava. Trachytic rocks are found at several points on the Youkon. There are, on the northeast shores of Norton Sound, abundance of sandstones, and clay beds containing lignite. Sandstone is abundant also on the Youkon, alternating with azoic rocks. The superincumbent soil differs in different places. In some localities it is clayey, and in such situations quite frequently covered with sphagnum, which always impoverishes the soil immediately below it. In others it is light and sandy, and over a large extent of country it is the richest alluvial, composed of very fine sand, mud, and vegetable matter, brought down by the river, and forming deposits of indefinite depth.

In some localities fresh-water marl is found in abundance, and is used for mortar or plaster, to whiten the walls of log-houses.

The soil is usually frozen at a depth of three or four feet in ordinary situations. In colder ones, it remains icy to within eighteen inches of the surface. This layer of frozen soil is six or eight feet thick;

PLATE IV

VIEW IN ALASKA.—CHARACTERISTIC VEGETATION OF THE BANKS OF THE YOUKON RIVER.

below that depth the soil is destitute of ice, except in very unusual situations.

This singular phenomenon appears to be directly traceable to want of drainage, combined with a non-conductive covering of moss, which prevents the soil from being warmed by the scorching sun of a boreal midsummer. In places where the soil is well drained, and is not covered with moss, as in the large alluvial deposits near the Youkon mouth, I have noticed that the frozen layer is much further below the surface, and in many places appeared to be absent. I have no doubt that in favorable situations, by draining and deep plowing, the ice could, in the course of time, be wholly removed from the soil.

A singular phenomenon on the shores of Kotzebue Sound was first observed by Kotzebue and Chamisso, and is described in the narrative of the voyage of the Rurik, and afterward by Buckland in the appendix to the voyage of the Herald. This consisted of bluffs or high banks, (thirty to sixty feet,) apparently of solid ice, covered with a few feet of vegetable matter and earth, in which a luxuriant vegetation was flourishing.

Kotzebue's description of this singular formation is highly colored; but the main facts were confirmed by Dr. Buckland and his companions, who made a careful examination of the locality, although Capt. Beechy had previously reported that Kotzebue had been deceived by snow drifted against the face of the banks and remaining, while that in other localities had melted away.

It is reported by Buckland and later observers that the formation is rapidly disappearing, and the water in the sound is becoming shoaler every day, from the fall of the débris which covers the ice.

No explanation having been offered of this singular phenomenon, I venture to suggest that it may be due to essentially the same causes as the subterranean ice layer, found over a great part of the Youkon Territory.

It is quite possible to conceive of a locality depressed, and so deprived of drainage, that the annual moisture derived from rain-fall and melting snow would collect between the impervious clayey soil and its sphagnous covering; congeal during the winter, and be prevented from melting during the ensuing summer by that mossy covering, which would thus be gradually raised; the process annually repeated for an indefinite period would form an ice layer which might well deserve the appellation of an "ice cliff," when the encroachments of the sea should have worn away its barriers, and laid it open to the action of the elements.

The lesson that the agriculturist may learn from this curious formation is, that a healthy and luxuriant vegetation may exist in immediate vicinity of permanent ice, bearing its blossoms and maturing its seed as readily as in apparently more favored situations; and hence that a large extent of northern territory long considered valueless may yet furnish to the settler, trader, or fisherman, if not an abundant harvest, at least a very acceptable and not inconsiderable addition to his annual stock of food, besides fish, venison, and game.

Climate.—The climate of the Youkon Territory in the interior differs from that of the sea coast, even in localities comparatively adjacent. That of the coast is tempered by the influence of the vast body of water contained in Behring's Sea, and many southern currents bringing warmer water from the Pacific; making the winter climate of the coast much milder than that of the country, even thirty miles into the interior. The summers, on the other hand, are colder than further inland, and the quantity of rain is greater. The following table shows the annual tem-

perature at St. Michael's Redoubt, on the coast of Norton Sound, in latitude 63° 28′ north; at the mission of the Russo-Greek church, on the Youkon River, one hundred and fifty miles from its mouth, in latitude 61° 47′ north; at Nulato, about six hundred miles from the mouth of the river, in latitude 64° 40′ north, or thereabouts; and at Fort Youkon, twelve hundred miles from the mouth of the river, and about latitude 66° 16′ north:

	St. Michael's.	Mission.	Nulato.	Ft. Youkon.
	°	°	°	°
[illegible]	+ 29.3	[illegible]	[illegible]	+ 14.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	+ 59.67
[illegible]	+ 26.3	[illegible]	[illegible]	+ 17.37
[illegible]	[illegible]	[illegible]	− 14.0	− 23.80
[illegible]	+ 29.3	[illegible]	+ 27.8	+ 16.92

The mean temperature at Unalaklik, on the east shore of Norton Sound, for the winter of 1866–'67 was 0.33°; but for that of 1867–'68 it was only about +9°. The mean annual temperature of the Youkon Territory as a whole may be roughly estimated as about +25°. The greatest degree of cold ever known in the territory was seventy degrees below zero, (—70°;) but such cold as this is very rare, and has little effect on the vegetation covered with eight or ten feet of snow. Running water may be found open on all the rivers, and in many springs throughout the year.

The real opportunity for agriculture in a cold country cannot be deduced from annual mean temperatures alone, but is dependent on the heat of the summer months and the duration of the summer.

At Fort Youkon I have seen the thermometer at noon, not in the direct rays of the sun, standing at 112°; and I was informed by the commander of the post that several spirit thermometers, graduated up to 120°, had burst under the scorching sun of the arctic midsummer, which can only be thoroughly appreciated by one who has endured it. In midsummer, on the Upper Youkon, the only relief from the intense heat, under which the vegetation attains an almost tropical luxuriance, is the two or three hours while the sun hovers near the northern horizon, and the weary voyager in his canoe blesses the transient coolness of the midnight air.

The amount of rain-fall cannot be correctly estimated, from want of data. At Nulato the fall of snow from November to April will average eight feet, but often reaches twelve. It is much less on the seaboard. Partly on this account, and also because it is driven seaward by the winds, there is usually, even in spring, very little snow on the coasts near Norton Sound.

In the interior there is less wind, and the snow lies as it falls among the trees. Towards spring the small ravines, gullies, and bushes are well filled or covered up, and transportation is easy and pleasant with a good sled and team of dogs. The warm sun at noon melts the snow a little, forming a hard crust. Over this the dog-sleds can go anywhere, making from thirty to fifty miles a day, carrying full one hundred pounds to a dog, and requiring for each dog only one dry fish per diem, which weighs about a pound and a half, and which you can buy for two leaves of tobacco. Seven dogs are the usual number for one team.

The rain-fall, as has previously been remarked, is much greater on the coast than in the interior. Four days in a week will be rainy in summer at St. Michael's, although the months of May, June, and part of July

abound in sunny weather. The last part of July, August, and most of September are very rainy. October brings a change; the winds, usually from the southwest from July to the latter part of September, now are mostly from the north, and though cold, bring fine weather.

The valley of the Lower Youkon is foggy in the latter part of the summer, but as we go up the river the climate improves, and the short summer at Fort Youkon is dry, hot, and pleasant, only varied by an occasional shower. The great pests in the spring, all along the river, are the mosquitoes, the numbers of which are beyond belief; but they retire about the middle of July. On the coast they are not so numerous, but linger until the fall.

Inhabitants.—The native inhabitants, curiously enough, are divided by the same invisible boundary that marks the vegetation. All along the treeless coast we find the Esquimaux tribes; passing a few miles inland we come to trees and Indian lodges. This holds good all over the Youkon Territory. The Esquimaux extend all along the coast and up the principal rivers as far as there are no trees. The Indians populate the interior, but seldom pass the boundary of the woods. In regard to habits, neither perform any agricultural labor whatever, and the only vegetables, besides berries, used for food, are the roots of *Hedysarum Mackenzii*, *Polygonum viviparum*, and a species of *Archangelica*, and the leaf stalks of a species of *Rheum* or wild rhubarb.

A great delicacy among the Esquimaux is the stomach of the reindeer, distended with willow sprigs, well masticated, and in a half-digested state. This "gruesome mass" is dried for winter use; when it is mixed with melted suet, oil, and snow, and regarded by the consumers much as we regard *caviar*, or any other peculiar dainty. It is, no doubt, a powerful antiscorbutic. The Russian settlements in the Youkon Territory were few in number. There were four on the Youkon; one on the Kuskoquim River; two on Norton Sound; and one on Bristol Bay. All of these were formerly provided with gardens. The number of Russians in the territory at no time exceeded forty, with double the number of half-breeds, assistants, or workmen. They were all in the employ of the Russian American Company. Many of them left the country after the purchase, but the greater number remain in the employ of different American trading companies. The Russian-born inhabitants were a very degraded class, almost without exception convicts from Siberia or elsewhere. The creoles or half-breeds are a more intelligent and docile race, but lazy, and given to intoxication whenever stimulants are within their reach.

Natural productions.—The first need of traveler, hunter, or settler, in any country, is timber. With this almost all parts of the Youkon Territory are well supplied. Even the treeless coasts of the Arctic Ocean can hardly be said to be an exception, as they are bountifully supplied with driftwood, brought down by the Youkon, Kuskoquim, and other rivers, and distributed by the waves and ocean currents.

The largest and most valuable tree found in this territory is the white spruce, *(Abies alba.)* This beautiful conifer is found over the whole country, but it is largest and most vigorous in the vicinity of running water. It attains not unfrequently the height of sixty to one hundred feet, with a diameter of over three feet near the butt; but the more common size is about thirty or forty feet high, and about eighteen inches at the butt. The wood of this tree is straight-grained, easily-cut, white and compact, and while very light, it is also very tough, much more so than the wood of the Oregon pine, *(Abies Douglasii.)* For spars it has no superior, but it is rather too slender for large masts. The

bark* is used for roofing by the Hudson Bay Company at Fort Youkon, and the roots, properly prepared, for sewing their birch canoes and dishes, by the Indians. I have seen log-houses twenty years old, in which many of the logs were quite sound. The unsound logs were said to be those which had been used without being seasoned. These trees decrease in size and grow more sparingly toward Fort Youkon, but are still large enough for most purposes. The unexplored waters of the Tananah River bring down the largest logs in the spring freshets. The number which are annually discharged from the mouth of the Youkon is truly incalculable. It supplies the shores of Behring Sea, the islands, and the arctic coasts; logs of all sizes lie in winrows, where they are thrown upon the shore by the October southwesters.

The wood is put to manifold uses: houses, Indian lodges, &c., are all constructed of spruce. Soft, fine-grained, and easily cut, the Indians of the Lower Youkon spend their leisure, during the short winter days, in carving dishes, bowls, and other utensils, and ornamenting them with red oxide of iron, in patterns, some of which, though far from classical, are very neat.

Sleds, frames for skin boats, fishing rods, &c., are made by the Esquimaux from spruce, and all their houses and casinos, or dance-houses, are built of it. One of these, on Norton Sound, about thirty by forty feet square, had on each side shelves or seats formed of one plank, four inches thick and thirty-eight inches wide at the smaller end. These enormous planks took six years to make, and were cut out of single logs with small stone adzes.

The next most important tree is the birch, *(Betula glandulosa.)* This tree rarely grows over eighteen inches in diameter and forty feet high; on one occasion, however, I saw a water-worn log about fifteen feet long, quite decorticated, lying on the river bank near Nuklukahyet, on the Upper Youkon, which was twenty-four inches in diameter at one end and twenty-eight at the other. This is the only hardwood tree in the Youkon Territory, and is put to a multiplicity of uses. Everything needing a hard and tough wood is constructed of birch. Sleds, snow-shoes, standards for the fish traps, and frames of canoes, which are afterwards covered with its bark, sewed with spruce or tamarack *(Larix)* roots, and the seams calked with spruce gum. The black birch is also found there, but does not grow so large. The soft new wood of the birch, as well as of the poplar, is cut very fine and mingled with his tobacco by the economical Indian. The squaws at certain periods wear birchen hoops around their necks; and neck-rings and wristlets of the same wood, with fantastic devices scratched upon them, are worn as a token of mourning for dead friends by the Tananah Indians.

Several species of poplar *(Populus balsamifera* and *Populus tremuloides)* abound, the former along the water-side, and the latter on drier uplands. The first-mentioned species grows to a very large size. The trees are frequently two or three feet in diameter and from forty to sixty feet high. The timber is of little value, but the Indians make small boards, for different purposes, out of the soft wood, and use the feathery down from the catkins for making tinder, by rubbing it up with powdered charcoal.

Willows are the most abundant of trees. They are of all sizes, from the slender variety on the Lower Youkon, which grows seventy or eighty feet high while only six inches in diameter at the butt, and with a mere wisp of straggling branches at the extreme tip, to the dwarf willow, crawling under the moss, with a stem no bigger than a lead pencil, and throwing up shoots a few inches high. Willows are almost invariably

rotten at the heart, and are only good for fuel. The Kutchin Indians make bows of the wood to shoot ducks with; as its elasticity is not injured by being wet. The inner bark is used for making twine for nets and seines by the Indian women, and the Esquimaux of Behring Straits use willow bark to color and tan their dressed deer-skins. It produces a beautiful red-brown, somewhat like Russia leather. The inner bark or cambium of the alder *(Alnus rubra)* is used for the same purpose.

The other species rising to the rank of trees in this district are the larch (*Larix dahurica?*), which is found on rolling prairies, of small size; a small birch (*Betula nana*,) and several alders (*Alnus viridis* and *incana*,) a species of Juniper (*Juniperus*.) and numberless willows, (*Salicae*.) A species of pine (*Pinus cembra*) has been reported from Kotzebue Sound, I cannot but think erroneously, as I saw no true pines in the territory during a two years' exploration. The most northern point touched by the *Pinus contorta*, at the junction of the Lewis and the Pelly Rivers, at Fort Selkirk, in latitude 63° north, longitude 137° west (approximate.) The Hudson Bay men at Fort Youkon call the white spruce "pine."

Fodder.—The treeless coasts of the Youkon Territory are covered, as well as the lowlands of the Youkon, with a most luxuriant growth of grass and flowers. Among the more valuable of these grasses (of which some thirty species are known to exist in the Youkon Territory) is the well known Kentucky blue-grass (*Poa pratensis*,) which grows luxuriantly as far north as Kotzebue Sound, and perhaps to Point Barrow.*

The wood meadow-grass (*Poa nemoralis*) is also abundant, and furnishes to cattle an agreeable and luxuriant pasturage.

The blue-joint grass (*Calamagrostis Canadensis*) also reaches the latitude of Kotzebue Sound, and grows on the coast of Norton Sound with a truly surprising luxuriance, reaching in very favorable localities four or even five feet in height, and averaging at least three. Many other grasses enumerated in the list of useful plants grow abundantly, and contribute largely to the whole amount of herbage. Two species of *Elymus* almost deceive the traveler with the aspect of grain fields maturing a perceptible kernel, which the field-mice lay up in store.

The grasses are woven into mats, dishes, articles of clothing for summer use, such as socks, mittens, and a sort of hats, by all the Indians, and more especially by the Esquimaux.

In winter the dry grasses, collected in summer for the purpose, and neatly tied in bunches, are shaped to correspond with the foot, and placed between the foot and the seal-skin sole of the winter boots worn in that country. There they serve as a non-conductor, keeping the foot dry and warm, and protecting it from contusion to an extent which the much-lauded moccasins of the Hudson Bay men never do. In fact, I believe the latter to be, without exception, the worst, most uncomfortable, and least durable covering for the foot worn by mortal man.

Grain has never been sown on a large scale in the Youkon Territory. Barley, I was informed, had once or twice been tried at Fort Youkon, in small patches, and the grain had matured, though the straw was very short. The experiments were never carried any further, however, the traders being obliged to devote all their energies to the collection of furs. No grain had ever been sown by the Russians at any of the posts. In the fall of 1867 I shook out an old bag, purchased from the Russians, which contained a handful of mouse-eaten grain, probably wheat; the

*For the determination of the species, and many interesting facts, I am indebted to Dr. J. T. Rothrock, professor of botany in the Agricultural College of Pennsylvania, and late botanist to the scientific corps of the Western Union Telegraph Company's exploring expedition. His report on the flora of Alaska will be found in the Smithsonian report for 1867.

succeeding spring, on examining the locality, quite a number of blades appeared, and when I left Nulato, June 2d, they were two or three inches high, growing rapidly. As I did not return, I cannot say what the result was. Turnips and radishes always flourished extremely well at St. Michael's, and the same is said of Nulato and Fort Youkon.

Potatoes succeeded at the latter place, though the tubers were small. They were regularly planted for several years, until the seed was lost by freezing during the winter. At St. Michael's they did not do well. Salad was successful, but cabbages would not head.

The white round turnips grown at St. Michael's were the best I ever saw anywhere, and very large, many of them weighing five or six pounds. They were crisp and sweet, though occasionally a very large one would be hollow-hearted. The Russians preserved the tops also in vinegar for winter use.

Cattle.—I see no reason why cattle with proper winter protection might not be successfully kept in most parts of the Youkon Territory. Fodder, as previously shown, is abundant. The wild sheep, moose, and reindeer abound, and find no want of food.

A bull and cow were once sent to Fort Youkon by the Hudson Bay Company. They did well for some time, but one day, while the cow was grazing on the river bank, the soil gave way and she was thrown down and killed. Due notice was given of the fact, but for a year or two the small annual supply of butter in the provisions for Fort Youkon was withheld on the ground of there being "cattle" (to wit, the bull) at that post. Finally the commander killed the animal, determined that if he could not have butter he would at least have beef. It will be remembered that this point is north of the Arctic Circle, and the most northern point in Alaska inhabited by white men.

Fruits.—There are, as might be supposed, no tree fruits in the Youkon Territory suitable for food. Small fruits are there in the greatest profusion. Among them may be noted red and black currants, gooseberries, cranberries, raspberries, thimble-berries, salmon-berries, blueberries, killikinik berries, bearberries, dewberries, twinberries, service or heath-berries, mossberries, and roseberries; the latter, the fruit of the *Rosa cinnamomea*, when touched by the frost, form a pleasant addition to the table, not being dry and woolly, as in our climate, but sweet and juicy.

All these berries, but especially the salmon-berry or "*morosky*" of the Russians (*Rubus chamaemorus*,) are excellent anti-scorbutics. They are preserved by the Esquimaux in large wooden dishes or vessels holding five gallons or more; covered with large leaves, they undergo a slight fermentation, and freeze solid when cold weather comes. In this state they may be kept indefinitely; and a more delicious dish than a plateful of these berries, not so thoroughly melted as to lose their coolness, and sprinkled with a little white sugar, it would be impossible to conceive.

The Russians also prepare a very luscious conserve from these and other berries, relieving the sameness of a diet of fish, bread, and tea, with the native productions of the country.

ALEUTIAN DISTRICT.

This comprises the Aleutian Islands and part of the peninsula of Aliaska, with the islands about it. Kadiak and the islands immediately adjoining it, however, belong more properly to the Sitkan district.

These islands are merely the prolongation of the Alaskan range of mountains. Many of them contain volcanic peaks, some still in a state

PLATE V.

VIEW IN ALASKA.—CHARACTERISTIC VEGETATION OF THE ALEUTIAN DISTRICT—ILIULUK BAY, UNALASHKA.

of moderate activity. Slight shocks of earthquake are common, but many years have elapsed since any material damage was done to life or property by volcanic action. Most of the islands have harbors, many of them safe and commodious. The soil is much of it rich, consisting of vegetable mold and dark-colored clays, with here and there light calcareous loam, formed by the decomposition of tertiary strata rich in fossils. In many places the growth of *sphagnum*, indicating want of drainage, prevails over the perennial grasses natural to the soil, but the remedy is self evident.

On some places the soil is formed of decomposed volcanic products, such as ash and pumice. Much of this is rich and productive.

Climate.—The climate of the islands is moist and warm. The greatest cold recorded in five years by Father Veniaminof in Unalaska was zero of Fahrenheit. This occurred only once. The greatest height of the mercury was seventy-seven degrees of Fahrenheit. The following table will show the range of the thermometer and the relative frequency of good and bad weather:

Thermometer.

Year.	7 a. m.	1 p. m.	9 p. m.	Extreme heat.	Extreme cold.	Range.
1830	35°	38°	34°	77°	0	77
1831	36	40	34	64	7	57
1832	39	42	38	77	7	70
1833	38	41	36	76	5	71
Average five years	37	40.5	36	77	0	77

Weather, average of seven years.

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Days all clear	11	9	3	4	2	6	0	5	2	2	3	6	53
Days half clear, half cloudy	111	86	112	104	105	95	118	106	107	115	88	116	1263
Days all cloudy or foggy, with or without snow, rain, or hail.	95	103	102	102	104	109	99	106	101	100	119	95	1235

These observations were taken in Iliouluk by Rev. Father Innocentius Veniaminof, now or lately bishop of Kamchatka. He notices that, from October to April, the prevalent winds are north and west; and from April to October, south and west. The thermometer is lowest in January and March, and highest in July and August. At this point it may not be superfluous to insert, as a means of comparison, a few statistics in regard to a very similar country, which has, however, been under cultivation for centuries. It will serve to show what human industry and careful application of experience may do with a country colder and more barren and nearly as rainy as the Aleutian and northern Sitkan districts of Alaska. I refer to the highlands of Scotland, and the Hebrides, whose "Scotch mists" have become proverbial.

Aiton* has ascribed the more rainy and cold climate of Scotland to the accumulations of sphagnum: "Thirty-two and a half ounces of dry moss soil will retain without fluidity eighteen ounces of water; while thirty-nine ounces of the richest garden mould will only retain eighteen and a half ounces. Moss is also more retentive of cold than any other

* Treatise on Peat-moss, &c. See Edinburgh Encyclopedia, p. 738, vol. xvi.

soil. Frost is often found to continue in deep mosses (in Scotland) until after the middle of summer. Hence the effect of mossy accumulations in rendering the climate colder."

Dr. Graham, of Aberfoyle, referring to the western district of Scotland, says that Ayrshire is very moist and damp, with a mild and temperate climate.

Renfrewshire is visited with frequent and heavy rains. Dumbartonshire has the same character. Argyleshire is considered the most rainy county of Scotland.

"The vapors of the ocean are attracted by its lofty mountains, and the clouds discharge themselves in torrents on the valleys."* "The winters are for the most part mild and temperate, but the summers are frequently rainy and cold. The climate of the Zetland Isles resembles in most respects that of the Orkneys. Though the sky is inclement and the air moist, it is far from unhealthy. The rain continues not only for hours but for days: nay, even for weeks if the wind blow from the west," &c. Substitute Alaska for Scotland, and the description would be equally accurate.

Mean temperature of Inverness.†

	Year.	Winter.	Spring.	Summer.	Fall.
[illegible]	47.83	39.59	44.93	55.34	49.90
[illegible]	48.02	39.44	47.22	57.79	47.59

At Drymen, in Stirlingshire, the average for fourteen years was two hundred and five days, more or less rainy, per annum; the average on the island of Unalaska was one hundred and fifty for seven years, according to Veniaminof. The average rain-fall in Stirlingshire was about forty-three inches; in Unalaska, was forty-four inches, (approximate.)

Let us now examine the productions of this country, so nearly agreeing in temperature and rain-fall with what we know of the Aleutian district. It may reasonably prove an approximate index to what time may bring to pass in our new Territory.‡

Agricultural statistics of the Highlands of Scotland, and islands, in 1854 and 1855.

	Occupants.	Bushels of wheat.		Bushels of barley.		Bushels of oats.	
	1855.	1854.	1855.	1854.	1855.	1854.	1855.
Argyle	[illegible]	7,315	[illegible]	[illegible]	46,819	806,395	[illegible]
Arran	[illegible]	4,373	[illegible]	1,974	[illegible]	[illegible]	[illegible]
Caithness	[illegible]	4,644	5,697	9,549	[illegible]	748,215	[illegible]
Inverness	[illegible]	47,573	37,814	93,100	64,957	437,584	[illegible]
Orkney	[illegible]	180	393	5,727	2,746	238,728	[illegible]
Zetland	[illegible]						
Ross and Cromarty	[illegible]	220,179	233,018	264,112	204,417	620,035	493,042
Sutherland	141	10,183	[illegible]	51,936	35,759	93,637	[illegible]
Total	4,340	294,447	303,799	483,193	362,726	[illegible]	[illegible]

* Edinburgh Encyclopedia, vol. xvi, p. 739.

† Lat. 57° 30'.—Kadiak is precisely the same.

‡ These statistics are official, from the Transactions of the Highland and Agricultural Society of Scotland, vol. xv, 1856.

Agricultural statistics of the Highlands of Scotland, &c.—Continued.

	Bushels of rye.		Bush. of beans and peas.		Cwt. of turnips.		Cwt. of potatoes.	
	1854.	1855.	1854.	1855.	1854.	1855.	1854.	1855.
Argyle	65, 144	59, 093	15, 147	21, 641	84, 907	103, 444	10, 504	26, 412
Arran	7, 086	4, 655	4, 403	3, 523	6, 497	4, 344	671	1, 493
Caithness	98, 924	56, 292	....	....	143, 416	120, 787	8, 310	5, 931
Inverness	23, 068	22, 206	2, 572	5, 227	64, 984	73, 948	6, 519	12, 176
Orkney } Zetland }	108, 168	105, 525	342	....	39, 230	42, 536	6, 532	6; 261
Ross and Cromarty	4, 604	6, 167	8, 273	21, 834	160, 145	163, 834	17, 281	20, 876
Sutherland	1, 065	2, 693	....	114	32, 052	29, 707	1, 540	1, 638
Total	308, 059	256, 631	30, 737	52, 339	551, 231	528, 600	51, 357	74, 782

	Acres of Swedish turnips.		Acres of carrots.		Acres of cabbage.		Acres of flax.	
	1854.	1855.	1854.	1855.	1854.	1855.	1854.	1855.
Argyle	28	33	24	17	23	28	26	15
Arran	22	10	4½	4	7	5	12½	....
Caithness	28	....	¼	....	10	9	7	15
Inverness	10	17	4	2	35	26	2	3
Orkney	....	2	4	4	30	35	1	1
Zetland	....	....	1	1	6	7	....	....
Ross and Cromarty	23	15	4	1	9	5	3	1
Sutherland	....	....	2	4	3	2	....	1
Total	111	77	43¾	33	123	117	49½	36

	Acres of grass and hay.		Horses.	Cows and oxen.	Sheep.	Swine.
	1854.	1855.	1855.	1855.	1855.	1855.
Argyle	36, 151	40, 303	8, 512	60, 378	814, 029	3, 458
Arran	3, 002	2, 588	2, 367	3, 010	25, 630	360
Caithness	19, 043	18 076	801	14, 659	60, 447	1, 149
Inverness	15, 313	14 226	3, 485	24, 061	567, 694	1, 667
Orkney }	4, 954	8, 297	2, 437	8, 128	10, 815	1, 337
Zetland }	232	535		1, 250	5, 845	50
Ross and Cromarty	19, 641	20, 491	4, 414	16, 190	288, 015	4, 557
Sutherland	3, 936	4, 446	914	3, 642	200, 553	550
Total	102, 272	108, 962	22, 930	131, 318	1, 973, 028	13, 128

It will be noted from these statistics that the quantity of potatoes and also the quantity of wheat is small, when compared with the other root crops or cereals.

The small Highland cattle are well known, and, like the small Siberian stock, admirably suited to such a climate and country. They produce tender, well-flavored beef, and extremely rich cream and butter.

The climate of Scotland furnishes a very complete parallel with that of the Aleutian district of Alaska. The eastern coast, defended from the vapors of the Atlantic currents by its sheltering mountains, is much drier, and the extremes of temperature are greater than on the western coast and the islands, resembling the eastern part of Cook's Inlet in this respect, and the interior of Alaska generally.

Veniaminof states that in Unalaska the greatest number of perfectly clear days are in January, February, and June, and usually follow a northerly wind. The barometer ranges from 27.415 inches to 29.437

inches, and, on the average, is highest in December and lowest in July; rising with a north and falling with a south wind.

Inhabitants.—The inhabitants of these islands are the Aleuts; true Esquimaux by descent, but altered by an insular life, isolated from other tribes, and changed by long contact with the Russians. They all nominally belong to the Greek Catholic faith, and practice the rites of that religion. Many can read and write the ecclesiastical or old Slavonic characters, which they have been taught by the priests.

They are faithful, docile, enduring, hardy, but lazy, phlegmatic, and great drunkards. They make good sailors but poor farmers, and chiefly occupy themselves in hunting and fishing. There are, perhaps, in all, fifteen hundred of them, male and female; and it can be said, to their credit, that for honesty they far surpass the majority of civilized communities.

Vegetation.—There is no timber of any kind larger than a shrub on these islands, but there does not appear to be any good reason why trees, if properly planted and drained, should not flourish. A few spruces were, in 1805, transplanted from Sitka, or Kadiak, to Unalaska. They lived, but were not cared for, or the situation was unfavorable, as they have increased very little in size since that time, according to Chamisso. The grasses in this climate, warmer than that of the Youkon territory and drier than the Sitkan district, attain an unwonted luxuriance. For example, Unalaska,* in the vicinity of Captains' Harbor, abounds in grasses, with a climate better adapted for haying than that of the coast of Oregon. The cattle were remarkably fat, and the beef very tender and delicate; rarely surpassed by any well-fed stock. Milk was abundant. The good and available arable land lies chiefly near the coast, formed by the meeting and mingling of the detritus from mountain and valley with the sea-sand, which formed a remarkably rich and genial soil, well suited for garden and root crop culture. It occurs to us that many choice sunny hillsides here would produce good crops under the thrifty hand of enterprise. They are already cleared for the plow. Where grain-like grasses grow and mature well, it seems fair to infer that oats and barley would thrive, provided they were fall-sown, like the native grasses. This is abundantly verified by reference to the collections. Several of these grasses had already (September) matured and cast their seed before we arrived, showing sufficient length of season. Indeed no grain will yield more than half a crop of poor quality, (on the Pacific slope,) when spring-sown, whether north or south.

The Russians affirm, with confirmation by later visitors, that potatoes are cultivated in almost every Aleutian village; and Veniaminof states that at the village in Isanotsky Strait, they have raised them and preserved the seed for planting, since the beginning of this century; the inhabitants of this village by so doing having escaped the effects of several severe famines, which visited their less provident and industrious neighbors.

Wild peas grow in great luxuriance near Unalaska Bay, and, according to Mr. Davidson, might be advantageously cultivated. This species, the *Lathyrus maritimus* of botanists, grows and flourishes as far north as latitude 64°. The productions of all the islands to the westward resemble those of Unalaska.

In September, says Dr. Kellogg, the turnips here were large and of excellent quality; carrots, parsnips, and cabbages lacked careful atten-

*See report of Dr. A. Kellogg on the Botany of Alaska, H. Ex. Doc. 177, 40th Congress, second session, page 218.

PLATE VI.

VIEW IN ALASKA.—CHARACTERISTIC VEGETATION OF THE SITKAN DISTRICT—DEEP LAKE, NEAR SITKA.

tion, but were good. Wild parsnips are abundant and edible through all these islands. At the height of two thousand four hundred and fifty feet above the sea most vegetation ceases.

From the reports of Dr. Kellogg and others, there appears to be no doubt that cattle can be advantageously kept in the Aleutian district, provided competent farmers will take the matter in hand.

The winter climate is as mild as that of the highlands of Scotland or the Orkneys, where stock has been successfully kept from time immemorial. Golovin states that, at one time, the company proposed to furnish the Aleuts with stock, gratis, in order to promote agriculture, and prevent the famines caused by taking them off to hunt sea otter during the fishing season. The Aleuts, totally ignorant of the management of cattle, did not succeed very well. The cows, which they confined at night in the low buildings where their dry fish is hung up, knocked it down and trampled on it; they did not know how to milk them; the hogs rooted up their garden patches; and the goats had a fancy for jumping over the tents in which they slept in summer, and knocking them down, to the great discomfort of the family, so they were very glad to get rid of them. In Cook's Inlet the natives were more intelligent, or had more experience, and their catttle did much better.

Hogs were placed on the island near the Churnobour reef in 1825, and multiplied exceedingly, living on the wild parsnips and other native plants, but were destroyed during the eruption of the volcano on the neighboring island of Ounimak in 1827, by the tidal waves accompanying that phenomenon.

THE SITKAN DISTRICT.

This district extends from the southern boundary to the peninsula of Aliaska, including the island of Kadiak.

The surface of this portion of the Territory is rugged and mountainous in the extreme, the northern part only affording any appreciable amount of level and arable lands suitable for cultivation. Small patches occur here and there where small farms might be located, but, as a rule, the mountains descend precipitously into the sea, with their flanks covered with dense and almost impenetrable forests. These rise to the level of about fifteen hundred feet above the sea. Here and there a bare streak shows where an avalanche has cut its way from the mountain top to the waterside; and occasionally the shining front of a glacier occupies some deep ravine, contrasting curiously with the dense foliage on either side.

The canals and channels of the Alexander Archipelago form the highways of the country, and so intricate and tortuous are they, that they afford access to almost every part of it, without setting foot on shore.

Soil.—The soil is principally decayed vegetable mold, with substrata of gravel or dark-colored clay.

The soil of Kadiak and Cook's Inlet is of a similar character, but from an admixture of volcanic sand thrown up by the waves, and abundant sandstone strata, it is lighter, drier, and better adapted for cultivation.

Climate.—The climate of the southern portion of this district is intolerably rainy. The annual rain-fall at Sitka varies from sixty to ninety-five inches, and the annual number of more or less rainy days varies from one hundred and ninety to two hundred and eighty-five. In Unalaska the annual number of rainy days is about one hundred and fifty, and the annual fall of rain (and melted snow) is about forty-four inches. This last estimate is probably not too low for the island of Kadiak and

the eastern part of Cook's Inlet. The annual means of the temperature about Sitka are by no means low, in spite of the rainy summers. The following table will indicate the means for the several seasons during the year ending October 31, 1868, from the United States Coast Survey observations:

Sitka meteorological abstract

Season.	Mean Temp.	Rain-fall.	Fair days.	Cloudy days.	Rainy days.	Snowy days.
	Fahr.	*Inches.*				
Spring	42.6	14.64	22	70	33	15
Summer	55.7	10.14	21	71	36	0
Autumn	45.9	28.70	19	72	44	5
Winter	31.9	14.59	44	47	21	6
Year	44.07	68.07	106	260	134	26

Minimum temperature 11°, maximum temperature 71°, for the year.

It will be noted that the average temperature of the winter is hardly below the freezing point, the greatest degree of cold being eleven above zero. The average of many years' observation places the mean winter temperature about +33° Fahr., which is about that of Manheim, on the Rhine, and warmer than Munich, Vienna, or Berlin; and about the same as that of Washington (one thousand and ninety-five miles further south,) and warmer than New York, Philadelphia, or Baltimore.* The cloudiness and rain of the summer season, however, prevents it from being nearly as warm as at any of the places above mentioned. Very little ice is made at Sitka; the harbor is always open, and the island is noted for the abundance of a small species of humming bird.

Inhabitants.—These are principally Indians in the Alexander Archipelago. Treated with firmness and decision, they are harmless; but if vacillation or weakness mark the dealings of Americans, as they did the policy of the Russian American Company, massacres and other exhibitions of Indian virtue and courage will be the inevitable result. North of the archipelago, on the shores of Prince William Sound, and the north shore of Cook's Inlet, and on the whole of Aliaska Peninsula and the islands south of it, the inhabitants are of the Esquimaux stock, intelligent, ingenious and docile.

Natural productions.—In the southern part of this district, from an agricultural point of view, there is little beside the timber. Near Fort Simpson, Dr. Kellogg describes timothy, white clover, and medick, or burr clover, as flourishing with great luxuriance. Dr. Rothrock says the same of the native grasses in the interior. But south of Prince William Sound there is so litle low land, or prairie, that there is no good opportunity for raising fodder, and the climate would render its preservation extremely precarious. The character of the country is so rugged that it would hardly be advisable to keep many cattle; and grain-raising, on account of the moisture, is not to be thought of. At Sitka some vegetables do very well. Turnips, beans, peas, carrots, beets, lettuce, and radishes succeed well. Potatoes are small and watery from want of sun and excess of moisture. Cabbages are luxuriant, but will not head. Cereals fail. The milk and cream from a few cows are very good. Pork has a disagreeable flavor from being fed on fish entrails, &c.

*See report of Lorin Blodgett, in Rep. No. 37, Com. on Foreign Affairs, fortieth Congress, 2d session, page 36.

There was in 1865 one old horse, which had evidently seen better days. Poultry does not succeed well. Lutké says that the crows eat up all the young chickens, and also deprive the sucking pigs of their tails!

To the northern portion of this district the above remarks do not apply. Kadiak and Cook's Inlet, northeast of Fort Alexander, have comparatively colder winters and drier and warmer summers than the islands and coast to the west or south of them. Haying can be successfully carried on, the native grasses being valuable for fodder, green or dry, while the cultivated grasses succeed very well. Barley and oats have been successfully raised near the settlement of St. Nicholas, on Cook's Inlet. There is no want of wood; while it does not encroach on the lowland, which is clear of trees and underbrush. Dr. Kellogg says of Kadiak, "various herbs and grasses clothe the mountains to their summits. The summer climate here, unlike Sitka, is sufficiently fair for haying. We saw many mown valleys from which a good supply of hay from the native grasses had been secured. The cattle were fat, and milk abundant. The butter was yellow and appeared remarkably rich, though of a disagreeable flavor, which might be owing to the manner of making." The potatoes are better than at Sitka, but do not attain a very large size. It has been mentioned that the cattle distributed to the natives by the Russian American Company did very well in Cook's Inlet.

Timber.—The agricultural staple of the southern Sitkan district is timber. I name the forest trees in the order of their value. The yellow cedar (*C. Nutkænsis*, Spach.) is the most valuable wood on the Pacific coast. It combines a fine, close texture with considerable hardness, extreme durability, and pleasant fragrance. For boat-building it is unsurpassed, in addition to its lightness, toughness, ease of workmanship and great durability.*

After ascending some distance the mountain sides of the island of Sitka, the wood, which appears in increased denseness before us, consists particularly of a noble Thuja *(T. excelsa, C. Nutkænsis.)* This is the timber most valued here. It occurs frequently further down, but the more predominant spruce trees conceal it from view; but here it constitutes almost the entire timber.† From its agreeable perfume, it is known to the Russians as *dushnik*, or scented wood. This is the wood formerly exported to China, and returned to us as "camphor wood," &c., famous for excluding moths. In repairing old Fort Simpson, a stick of this wood, among the pine timbers used for underpinning, was found to be the only sound log after twenty-one years' trial. A wreck on the beach at Sitka, originally constructed of this timber, was found thirty-two years after as sound as the day it was built; even the iron bolts were not corroded.

Sitka spruce, or white pine (*Abies Sitkensis*.) This tree, well known in the lumber trade of the coast, attains a large size, and is noteworthy from its invariably straight and slowly tapering trunk. The wood is not so durable as the last species, but is available for many purposes. Hemlock (*Abies Mertensiana*, Bong.) This species is often confounded with the white pine by lumber dealers, who style them both "Sitka pine." It is much larger in its growth than the next species, but some botanists consider it a variety of the balsam. Balsam fir (*Abies Canadensis*, Mich.) The wood of this species is almost valueless, but the bark, as well as the bark of the last named, is used in tanning. Scrub pine (*Pinus contorta*, Dougl.) This species seldom grows more than

* See Kellogg, Rep. Bot. Alaska.
† Mertens, letter from, in Hooker's Bot. Misc., vol. iii.

forty feet clear trunk and eighteen inches in diameter. It passes as far north as the juncture of the Lewis and the Pelly rivers in the interior, but no further.

Other trees, such as the little juniper, wild pear, and the like, may be of some use, but from their small size or scarcity are of little economical value.

In Kadiak Dr. Kellogg found the growth of timber (*Abies Sitkensis*) confined to the eastern valleys and slopes of the island. The largest seen were three feet in diameter, and ninety to one hundred feet high. In the governor's yard were masts and spars over one hundred feet in length, scarcely tapering two inches in thirty or forty feet. These were from Kadiak; but many are brought in rafts from Spruce Island, ten or fifteen miles off.

The wooded district comprises the whole Alexander Archipelago, and the mainland north to Lituya Bay; from this point to Prince William Sound little is known of the character of the timber; but in the latter locality fine timber abounds, and also in the interior.

GENERAL SUMMARY.

While in the Youkon territory we cannot look for self-supporting agricultural districts, nor reasonably expect any one to obtain a sustenance by farming alone, still the settler called there to develop the resources of the country, be they lumber, fish, or furs, may have milk in his tea, and many vegetables on his table, if he possess the energy and knowledge to make the most of his opportunities. It will not be necessary for him to rely on the products of the chase alone, if he will but take the necessary care to provide shelter for his cattle, and to cut the perennial grasses which cover the prairies and lowlands for their fodder during the winter.

In the Aleutian district is situated the larger proportion of arable lands, and in this and the northern part of the Sitkan district the climatic conditions are the most favorable in the territory. Their resemblance to the conditions which prevail in Northwestern Scotland and its islands has been already demonstrated at length; and the capability of this district for agriculture may therefore be reasonably inferred. Oats and barley, possibly wheat and rye, may succeed on these islands. Their abundant capacity for producing root crops of good quality, except possibly potatoes, may be considered as settled. That cattle will do well there is no doubt; and the Pacific coast may yet derive its best butter and cheese from the Aleutian and Northern Sitkan district. Sheep, goats and swine have not been thoroughly tried as yet, but the inference is that they also would succeed.

Most of the berries found in the Youkon territory are common to the Aleutian district, and the climate, except from its moisture, presents no obstacles to the success of some kinds of fruit trees. It is to be hoped that some one will try the experiment. These islands, with the country around Cook's Inlet, are unquestionably the best agricultural region in our new possessions.

The resources of the southern Sitkan district lie apparently entirely in its timber. This is unquestionably needed on the Pacific slope, and is a most valuable acquisition. No better lumbering district could be imagined with water transportation everywhere, and mountain sides so steep that a slide, easily made of comparatively worthless timber, will conduct the more valuable logs directly to the water side.

Some vegetables will be raised in the future as in the past; and some

stock will be kept in this part of Alaska, but expectations should be moderate. To the northern part of this district the remarks on the Aleutian district will apply.

Many reports may be found in circulation, even in official documents, in regard to Alaska, which have very little foundation. It is believed that in this report nothing is asserted which is not susceptible of easy proof. It may be said that Massachusetts has never exported any native productions except granite and ice. Alaska, on the contrary, if we dismiss the fabulous stories of fossil ivory, and gold and silver, may be able in course of time to give not only ice, marble, coal, and ship timber, but butter and cheese, mutton and beef. Perhaps more palatable fruit may take the place of the cranberries, which have already found their way to San Francisco markets.

The illustrations accompanying the report are reduced from the botanical illustrations of Baron Kittlitz, by the well-known artist Miss E. B. Greene, and represent a characteristic scene, illustrating the vegetation of each of the three districts mentioned in this report.

In the compilation of the following list of useful plants indigenous to Alaska I am indebted for assistance to Mr. Wright, of the botanical garden at Cambridge, Dr. Rothrock, and Dr. C. C. Parry. It is short, containing only one hundred and eighteen species, including grasses.

USEFUL INDIGENOUS ALASKAN PLANTS.

Hepatica triloba, Chaix.—Sitka.
Coptis trifolia, Sal.—Sitka.
Coptis asplenifolia, Sal.—Sitka.
Aconitum, var. delphinifolium.—Sitka to Point Barrow.
Nasturtium palustre, D. C.—Youkon.
Cochlearia fenestrata, R. Br.—Norton Sound.
Linum perenne, L.—Youkon.
Trifolium repens, L.—Sitka.
Lathyrus maritimus, Big.—Sitka.
Hedysarum Mackenzii, Rich.—Youkon.
Rubus spectabilis, Pursh.—Sitka. Kadiak.
R. arcticus, L.—Kotzebue Sound.
R. pedatus, Sm.—Sitka.
R. chamœmorus, L.—Sitka.
R. Nutkanus, Mog.—Sitka.
Rosa cinnamomea, L.—Youkon.
Pyrus rivularis, Dougl.—Sitka.
P. sambucifolia, Cham.—Sitka.
Ribes rubrum, L. Youkon.
R. Hudsonianum, Rich.—Youkon.
R. prostratum, L. Herb.—Sitka.
R. bracteosum, Dougl.—Sitka.
R. lacustre, Pursh.—Pt. Barrow; fruit poor.
Archangelica officinalis, Hoff.—Sitka, &c.
A. Gmelini, D. C.—Sitka, islands, &c.
Panax horridum, Smith.—Sitka.
Sambucus pubens, Michx.—Sitka.
Valeriana dioica, L.—Norton Sound.
Vaccinium vitis idæa, L.—Sitka, Youkon.
V. myrtilloides, Hooker.—Sitka.
V. myrtillus, L.—Sitka.
V. Chamissonis, Bong.—Sitka and Unalaska.

V. ovalifolium, Smith.—Sitka.
V. parvifolium, Smith.—Sitka.
V. salicinum, Cham.—Unalaska.
V. cæspitosum, Michx.—Sitka.
V. uliginosum, L.—Sitka and northward.
Viburnum vulgaris, L.—Sitka and northward.
Arctostaphylos alpina, Spr.—Sitka and northward.
A. uva ursi, Spr.—Unalaska and northward.
Gentiana amarella, L.—Sitka.
Oxyria reniformis, Hook.—Sitka and northward.
Rumex salicifolius, Weinm.—Sitka.
R. acetosa, L.—Kotzebue Sound.
R. domesticus, Hartm.—Sitka, northward.
Polygonum viviparum.—Sitka, northward.
Empetrum nigrum, L.—Sitka, northward.
Myrica Gale, L.—Sitka.
Abies Canadensis, Michx.—Sitka.
A. Mertensiana, Bong.—Sitka.
A. Sitkensis, Bong.—Sitka.
A. alba, Michx.—Youkon.
Pinus contorta, Dougl.—Sitka.
Larix Dahurica, Mert.—Kadiak ? Youkon.
Cupressus Nutkænsis, Spach.—Sitka.
Juniperus communis, var. alpina.—Sitka.
Fritillaria Kamtschatkensis, Fisch.—Sitka, northward.
Allium schœnoprasum, L.—Youkon.
Veratrum Escholtzii, Gray.—Sitka.
Hordeum pratense, L.—Sitka.
H. jubatum, L.—Youkon.
Elymus Sibiricus, L.—Sitka.
E. arenarius, L.—Norton Sound.
E. mollis, Trin.—Sitka, northward.
Triticum repens, L.—Kotzebue Sound.
Festuca ovina, L.—Kotzebue Sound.
F. rubra, L.—Sitka and northward.
F. subulata, Bong.—Sitka.
Bromus ciliatus, L.—Kotzebue.
B. subulatus, Led.—Unalaska.
B. Aleutensis, Trin.—Unalaska.
B. Sitkensis, Bong.—Sitka.
Poa stenantha, Trin.—Unalaska.
P. flavicans, Sed.—Unalaska.
P. arctica, R. Br.—Sitka to Kotzebue.
P. cenisia, All.—Sitka to Kotzebue.
P. rotundata, Trin.—Unalaska.
P. nemoralis, L.—Kotzebue.
P. annua, L.—Sitka.
P. pratensis, L.—Kotzebue.
Colpodium fulvum, Led.—Kotzebue.
Dupontia psilosantha, Rupr.—Kotzebue.
Catabrosa aquatica, Beauv.—Sitka, Kotzebue.
C. algida, Fries.—Kotzebue.
Atropis maritima, Led.—Sitka.
A. angustata, Led.—Kotzebue.
Glyceria aquatica, Smith.—Sitka.
G. glumaris, Led.—Sitka, Kotzebue.

Hierochloa borealis, R. & S.—Kotzebue.
H. alpina, R. & S.—Kotzebue.
Trisetum subspicatum, Trin.—Kotzebue
T. sesquiflorum, Trin.—Unalaska.
T. cernuum, Trin.—Sitka.
Aira cæspitosa, Trin.—Unalaska.
Aira, var Bottnica, Trin.—Sitka.
A. arctica, Trin.—Sitka, Unalaska.
A. atropurpurea, Scheele.—Sitka, Unalaska.
Calamagrostis Aleutica, Trin.—Sitka, Unalaska.
C. purpurescens, R. Br.—Youkon.
C. strigosa, Wahl.—Sitka.
C. Laponnica, Trin.—Unalaska.
C. neglecta, Gaert.—Kotzebue Sound.
C. Canadensis, Beauv.—Kotzebue Sound.
C. Langsdorfii, Trin.—Kotzebue Sound.
Arctagrostis latifolia, Led.—Kotzebue Sound.
Cinna latifolia, Led.—Sitka.
Agrostis æquivalvis, Trin.—Sitka.
A. exarata, Trin.—Sitka.
A. geminata, Trin.—Unalaska.
A. laxiflora, R. Br.—Unalaska.
Phleum pratense, L.—Sitka, Fort Simpson.
P. alpinum, L.—Kotzebue, Sitka.
Alopecurus alpinus, Trin.—Kotzebue.

Other species will no doubt be added to this list upon more careful and extensive exploration.

WILLIAM H. DALL.

Hon. HORACE CAPRON, *Commissioner.*

REPORT OF THE EDITOR.

SIR: The abandonment of the long-continued usage of admitting voluminous and desultory essays into the annual report of the Department, which was contemplated and in part accomplished in the volume for 1867, is made complete in the present issue. It was difficult to recognize the propriety of competing with private publishers in the presentation of exhaustive treatises upon special topics, written by private individuals, and in no sense official, however valuable or complete the information presented.

While the domain of book-making and newspaper enterprise was invaded, the matter itself was not always of the kind contemplated by the organic act requiring reports upon agricultural progress and investigation. The essay was the work of a single mind, covering a limited field of observation, and prepared with the aid of private resources only. It was not a statement of results of Department labor and investigation. It was not legitimately an official report.

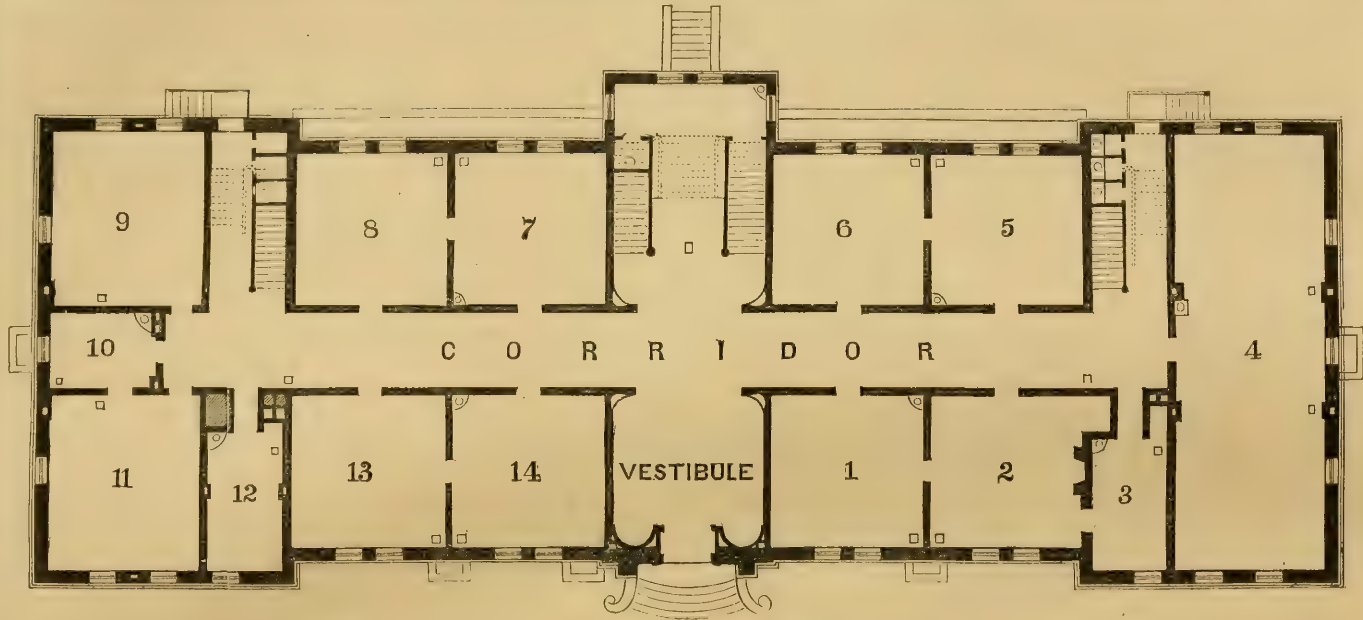
It is believed that the present system will command the approbation and appreciation of intelligent agriculturists. The annual report of the Department of Agriculture will consist of the reports of the Commissioner and of division officers and special agents of the Department, including, under the report of the editor of the annual, digests of the researches of the office, upon special and timely topics, demanded by the exigencies of the hour, and illustrative of the direction of rural effort and of the progress of the time. Such investigations may be made with the aid of a large corps of regular and special correspondents, of the State and local societies representing agriculture and horticulture, and of the diplomatic representatives of this country abroad, (who are extremely courteous in forwarding voluntary information and in responding to special inquiries,) as well as of experts in any line of research desired, who may be employed to compile and enlarge the matter in possession of the Department. Thus the work may not be deprived of the skill of individuals learned in some specialty, while its unity and consistency are not marred by views from many standpoints and irreconcilable differences in statements of fact and of opinion.

In this connection it is proper to state that the statistics of this office upon Roads and Road Laws were digested and the subject reviewed, as presented in these pages, by John Wilkinson, of Baltimore, landscape gardener and civil engineer. To Dr. Lee, of Tennessee, the Department is indebted for information presented in Concentrated Fertilizers in the southern States; to Thomas S. Pleasants, of Virginia, for matter concerning the Mineral Resources of Virginia; to W. S. Clark, president of the Massachusetts College, for the history of that institution; to G. S. Wagner, of the Bee Journal, for analysis of Department statistics upon bee-keeping; and to John S. Hittell, of California, for the matter relating to silk culture in that State. The Department is also indebted to thousands of regular and volunteer correspondents, who labor without reward for the advancement of their favorite calling, and whose records of experience and statements of fact are embodied in the matter presented in the following pages, as compiled by the editor of this volume and his assistants.

J. R. DODGE.

Hon. HORACE CAPRON, *Commissioner.*

Plate II.



ROOMS.
No. 1, office of Chief Clerk.
No. 2, office of Commissioner.
No. 3, private office of Commissioner.
No. 4, library.
No. 5, office of Disbursing Clerk.

ROOMS.
No. 6, reception room.
Nos. 7, 8, 13, and 14, offices.
Nos. 9, 10, and 11, rooms of Chemist.
No. 12, office of Superintendent of Garden.

PLAN OF FIRST FLOOR, DEPARTMENT OF AGRICULTURE.

DEPARTMENT BUILDING AND GROUNDS.

The new building of the Department of Agriculture is one hundred and seventy feet long by sixty-one feet deep, and consists of a finished basement, three full stories, and Mansard roof. Designed in the *renaissance* style of architecture, the front presents a center building with main entrance, flanked by two projecting wings. The material is pressed brick, with brownstone base, belts, trimmings, and cornices. Walking over a flight of swelled granite steps, the visitor passes through the main door, of oak and ash wood, into an octagonal vestibule of twenty feet square and sixteen feet high, the floor of which is laid with rosettes and borders of encaustic tiles, and the sides paneled in encaustic paint. The ceiling is decorated with fresco work, around a center, representing an arbor of vine foliage, and held by American eagles with spread wings; arabesque ornaments are sprung with four medallions illustrating in turn, by landscape, light effect, and human figures, spring, morning, and childhood; summer, noon, and youth; autumn, evening, and mature age; winter, night, and old age.

Around a wide corridor, similarly finished, but in plain style, are grouped office rooms of twenty by twenty feet in size. The reception room is chastely decorated, while the chief clerk's room is finished with an apparently solid molded and paneled wainscot in curly walnut, mahogany, and maple, covering the height of side walls, surmounted by frescoed stucco cornice and a ceiling in complementary colors. This wainscot is a specimen of the "American wood-hanging," which is an application of wood to the plastered walls. The wood is prepared in strips of different lengths, of about the thickness of paper, and is placed upon the walls by paper-hangers. The adjoining office of the Commissioner is done in the same material, but in a higher style of the art, the panels of rich bird's-eye maple being bordered by friezes of mahogany and blistered walnut, alternating with fancy paneled pilasters in mahogany and satin wood, all parted by curly maple and set off by gilt edges. This series of rooms is completed by the private office of the Commissioner, finished in plain library style, with friezes of birch, borders of black walnut, and panels of mountain ash. The rooms for clerical purposes are finished in plain encaustic oil paint, with frescoed ceilings—all in different colors. The western end of this story is occupied by the library, which is furnished with mahogany cases; and a suite of rooms on the eastern terminus is devoted to laboratory purposes, where all cumbersome apparatus is dispensed with; and an ample supply of gas furnishes the modern heating power.

A double flight of fire-proof stairs, of wrought and cast iron, in the center of the building, and opposite the vestibule, lit by a grand window glazed with stained glass, leads to the second story, the main or central part of which is appropriated to the Museum of Agriculture, a hall one hundred and two feet in length, fifty-two feet in width, and twenty-seven feet high. There are three large entrance doors, of six by twelve feet, of artistic design. The size and style of the ten windows, each seven by sixteen feet, partake of the character of the modern exhibition palaces. The hall is crowned by a bold coved stucco cornice, the lines of which are broken rhythmically by heavy brackets, in the sculpture of which colossal Indian busts form prominent feat-

ures. The grand cove itself is adorned by a chain formed of festoons and groups of flowers and fruits with medallion shields, into which the escutcheons of the United States, surrounded by those of the thirty-seven States of the Union in chronological succession, are worked. The ceiling is divided into fifteen heavily molded panels, the centers of which are occupied by rosettes conforming with each other in general outline, but each having distinct details. The colors of the hall are in neutral tints, which are diversified mainly by the heraldic colors of the escutcheons. The furniture of the hall consists of elegant glass cases, with solid, dust-proof walnut frames, surmounted by architraves, friezes, and cornices, bearing carved volutes with intermediate vases and busts. Perhaps the most noticeable piece of furniture is the redwood table, the top of which, seven and a half by twelve feet, is formed of the largest plank in the world, sent to the Department from California.

At the western terminus of the museum are located the working rooms of the entomologist, and a room of extra size, containing in walnut cases a valuable herbarium. At the eastern terminus of the museum are the rooms of the statistician.

The third story of the building contains rooms for miscellaneous purposes, assorting and putting up seeds, &c., and is in direct and easy communication with the basement by means of a large elevator.

The whole building is heated by steam, two boilers thirteen feet long by forty-eight inches diameter being located in a fire-proof apartment of the basement. Most of the rooms are heated by circulated air passing from outside through coils of steam pipes in the basement, and ascending in tin-lined flues, which feed the registers in the rooms. Each room has an independent heating power.

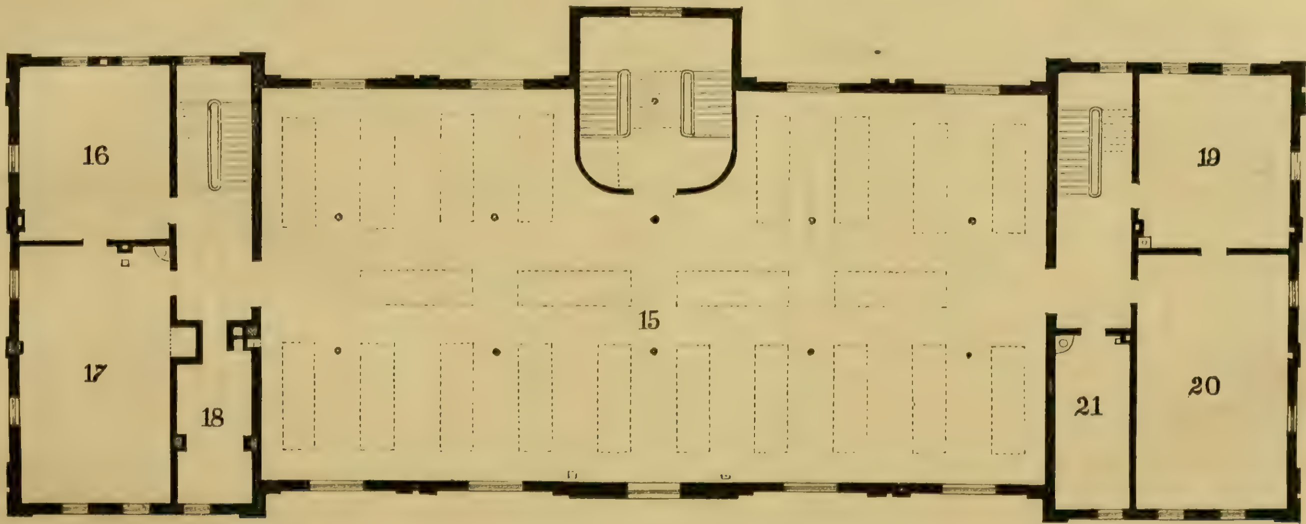
The whole work has been executed under the superintendence of Mr. Adolph Cluss, the architect.

GROUNDS OF THE DEPARTMENT OF AGRICULTURE.

For the purpose of preventing dampness in the walls, a water-tight concrete walk closely surrounds the building; opposite the principal front this concrete surface is fifty feet in width the entire length of the building, thus giving ample room for the approach and departure of carriages. The space in the immediate front is laid out as a strictly geometrical flower garden with architectural appendages, such as vases and statuary. It is divided by a terrace wall, to be ornamented with stone balusters and pediments for the reception of plant vases; communication with the lower garden being provided by stone steps, the whole forming a proper arrangement for the harmonious connection of the building and its surroundings. This connection is maintained at the ends by large growing trees, but the immediate front will be kept open, thus avoiding the common error of preventing the building from being viewed as an architectural design, a fault painfully apparent in many fine structures, in which beauty of their architectural features is wholly lost by dense growths of trees and shrubbery.

The plant houses are located west of the Department. The design includes a range of glass structures with a front three hundred and twenty feet in length by thirty feet in width. These include apartments for the culture of exotic fruits, of which a collection is being formed for a complete series of the citrus family, a class of fruits now extensively produced in Florida and other southern States, of which family several fine varieties of oranges and lemons have already been introduced and propagated for trial in this country, and for an extensive collection of

PLATE III.



ROOMS.

No. 15, museum.
Nos. 16 and 17, rooms of Statistician.
No. 18, bath-room.

ROOMS.

Nos. 19 and 21, rooms of Entomologist.
No. 20, Botanical collection.

PLAN OF SECOND FLOOR, DEPARTMENT OF AGRICULTURE.

medical plants, also those furnishing textile fibers, useful gums, sugars, and dyes. Structures for orchard houses, cold graperies, and other purposes, are to be extended in the rear; the entire design forming a compact and economic arrangement specially adapted to the various purposes contemplated in its erection.

The largest portion of the inclosed area upon which the building is located will be appropriated to an arboretum or a collection of hardy trees and shrubs. While these are planted in accordance with a botanical system, each order and tribe of plants being united, yet the landscape effect has been carefully studied, thus producing a combination altogether novel, that of forming pleasure-ground scenery, and retaining a strict systematic classification of the trees and shrubs employed in producing it.

About ten acres are set apart for experimental purposes, for testing varieties of small fruits, seeds, and for the propagation and culture of hardy plants.

HINTS IN HORTICULTURE.

HEDGES AND HEDGE PLANTS.

Live fences, as they are very properly termed, have long been held in high estimation for inclosures when plants suitable for the purpose could be secured. The maintenance of efficient fencing is a heavy tax upon all who occupy land, and the cost is greatly increased when the materials are difficult to procure, and require frequent repairs. If the chronological history of fences should ever be written, it might be divided into three epocns: the temporary, the equivocal, and the permanent: or the period of the wooden fence, the live fence, (possibly including the wire fence,) and the fence of stone. To obtain a good hedge requires a suitable plant, care in its formation, and proper keeping afterwards. Neglect of any one of these essentials will prove fatal to the object in view, whether as a protection against depredators or as a shelter for ameliorating local climates.

For farm hedges there are only two plants which can be considered as being perfectly satisfactory. These are the Osage orange and the honey locust. The Osage orange (*Maclura aurantiaca*) is perhaps to be preferred in localities where it is sufficiently hardy. It is cheaply produced, of rapid growth, thickens its branches freely when pruned, has formidable thorns, is not liable to insect injuries, not eaten by cattle, and will grow in any soil of ordinary fertility. The honey locust (*Gleditschia triacanthos*) is a good plant in more northern localities, where the Osage orange is destroyed by cold. It is also well supplied with thorns, is of rapid growth, and will make a fence as soon as the other. It has very beautiful and delicate foliage, and is more robust, but less dense, than the Osage—which is rather an advantage than otherwise for a strong fence. Some of the best hedges in the country are of this plant.

Seeds or plants of either of the preceding are easily obtained: but, where time is a matter of consideration, it will be advisable to procure plants, which are now produced in large quantities by nurserymen, and sold at prices much less than the cost of growing them on a small scale. It is scarcely possible to form a good hedge by sowing the seed on the position which the hedge is to occupy. The casualties of growth will certainly produce many weak plants that will be eventually destroyed by their stronger neighbors, leaving unsightly blanks, and greatly diminishing the uniform efficiency of the hedge. When the plants are properly assorted as to size before setting, an equality of growth is at once established.

In preparing the soil for a hedge-row, a breadth of three to four feet will be amply sufficient. If plowed, the ridges should be thrown toward the center, forming a slightly mounded finish. In stiff soils this can be done to a greater advantage in autumn by throwing the furrows on each side from the center of the hedge line, so that the frosts of winter may penetrate and loosen the subsoil; and then throwing them together in spring, to be ready for planting.

The best distance to set plants is from ten to fourteen inches apart, and in a single row. On poor soils, or for a mere ornamental dividing hedge, the closer distance may be adopted; and for a strong fence, or on rich soils, the wider will not be too great. They may be set either in

fall or spring, according to the location. If the position is elevated, and the soil naturally dry, fall planting is to be preferred; in low positions, or in wet soil, spring planting is safer, as the plants are liable, in such soils, to be thrown out of the ground during winter. Even in wet soils, however, the practice of planting in the fall has of late been adopted, and with perfect success, by placing the plants in a slanting position, instead of an upright one, and covering them slightly with litter. No hedge will be perfectly satisfactory in soils saturated with water during winter.

The perfection of a hedge, even with the best plants, depends altogether upon the treatment it receives in its early growth. Neglect in pruning, during this period, can seldom be remedied in after years; and to this, more than to any other cause, failures in forming good hedges may be attributed. A brief statement of the principles involved in forming them will, therefore, be given.

The only form in which a hedge can be kept, to be of service as a fence, is that of a pyramid. When it has attained a height of five feet, it should be at least three feet wide at the base or surface of the ground. All pruning must be directed with a view to securing this form. When the plants are first set out, they should be pruned back to within three inches of the ground, and allowed to grow undisturbed during the first season, their growth in the meantime being encouraged by judicious cultivation. At the termination of the yearly growth, the plants should again be pruned down to within four inches of the first pruning, and the side shoots below this point also be removed to within an inch of the main stem. This severe pruning of the branches will give to the roots a vigorous growth; and, when the buds burst in spring, strong shoots will immediately follow. During this second year's growth the hedge may be partially shaped by repressing the growth of the strongest perpendicular shoots, and encouraging those of horizontal tendency. Practically this is accomplished by going over the plants about the end of June, and cutting all upright shoots back to a point about eight inches above the previous winter pruning, taking care not to disturb a shoot or leaf on the side branches below that point. In thus cutting back the upright shoots, the side growth will be increased, and a breadth of base secured, which, at this stage of growth, is the most important point of all. In the following winter the hedge, if it has progressed at all favorably, may be pruned down to fourteen inches in height from the ground surface, with the horizontal branches extending from nine to twelve inches on each side. The principles of pruning are, that growth is repressed by summer trimming, and encouraged by pruning after the leaves have fallen. By keeping these facts in mind, and practicing accordingly, the shaping of a hedge is only a work of time. The lower branches can always be retained as healthy, and produce as much density of foliage as the upright portion of the plants, if the pyramidal form is strictly maintained: but if, at any time, the upright growth predominates, the lower limbs will proportionately lose vigor. The upright shoots should, therefore, be pruned during summer, in order to weaken the growth at that point, and to strengthen and keep the base of the hedge vigorous and close. The principal pruning of the lower branches should be performed during winter.

This is the only way in which a hedge can be made that will be effective as a fence; and the neglect of the principles here suggested is generally the origin of the conflicting opinions with regard to the value and efficiency of hedges as farm fences. They may receive some attention for a year or two, but when it becomes thoroughly understood that

they cannot be preserved unless trimmed during summer, when attention is wholly given to ordinary crops, farmers are not always disposed to give hedges the attention necessary to keep them in good condition; and therefore they fail to be of service. It should, however, be remembered that, as the hedge becomes perfect, the yearly labor to keep it in order gradually becomes less; and at no time does it require so much labor as that required to keep a common wooden fence in good repair.

For purposes of protection and shelter to gardens, or as dividing lines in the grounds of country and suburban residences, hedges are of the greatest utility. For these purposes there is an extensive choice of plants, both evergreen and deciduous. A well-grown evergreen hedge is found to be as congenial a protection for the garden as a brick wall. The commercial value of shelter, in accelerating early crops, is not so generally known as it deserves to be; yet it is fully appreciated and adopted by many of the most successful cultivators; and, as a means of arresting drying winds and lessening evaporation in level tracts destitute of trees, no just estimate can be made of the intrinsic value of close-foliaged hedges.

Among evergreen plants the Norway spruce (*Abies excelsa*) is the most valuable where a high, strong wind-break is necessary; and, for the purposes of sheltering orchards and vineyards, it is unsurpassed. It will, in time, form a very close and compact hedge when trimmed; but to produce an effective shelter in the shortest period, the plants should be set four to six feet apart in the row or line, and allowed to grow undisturbed, so far as pruning is concerned, until the leading or top shoot reaches the required height. Then by merely trimming the top, so as to keep it at this height, the side branches will spread and interlace, forming a screen quite as effective and more beautiful than a closely-clipped hedge.

For general purposes, perhaps the most useful plant, all things considered, for an evergreen hedge, is the American arbor-vitæ (*Thuja occidentalis*.) Its habit of changing to a dingy brown color during winter is a fault easily overlooked, and more than compensated by its numerous good qualities. It is a plant of free growth, readily transplanted, of comparatively small cost, and grows well in any good soil, but preferably in a clayey loam. Plants of one foot in height, set twelve to fourteen inches apart, will reach five feet in as many years. The variety *Siberica* is more compact in growth, and forms a perfect and shapely hedge, without any trimming whatever.

The most beautiful and graceful hedges are formed by the hemlock spruce (*Abies Canadensis*.) Although sometimes of slow growth after removal, yet it develops rapidly when once fairly established. Nothing can exceed the beauty of its pendant branches of delicate foliage; and no other plant will admit of shearing into so dense a wall of green as this. For a dividing line in the pleasure ground or flower garden it is most admirably suited.

When such beautiful, hardy evergreens as *Cupressus Lawsoniana* and *Cupressus Nutkaensis* become more plentiful, and can be procured in quantities at reasonable prices, they will be largely employed as hedge plants of the most select and choice kinds.

There is a great variety of deciduous plants well adapted for inside hedges, such as may be planted for protection of crops, or as ornamental dividing lines in gardens, but which will not be suitable as fences for stock; of these a few of the best may be mentioned:

The Buckthorn (*Rhamnus catharticus*,) although of slender growth, forms a tolerably good hedge. It has a glossy and lively green foliage,

which it retains quite into winter, thus affording protection for a lengthened period.

A very beautiful hedge can be produced from the common English maple (*Acer campestre.*) This small tree is naturally compact in its habit of growth, and requires very little pruning to keep it in form. For a shelter belt, when a smoothly-trimmed hedge may not be desired, this will be found suitable. It has small foliage, and the whole plant is eminently neat, hardy, and free from insects.

The European hornbeam (*Carpinus betulus*) is a good hedge plant. It has a very dense foliage, and the small ovate leaves are closely set on the branches. It is rather slow in growth, but, in consequence of not requiring to be shortened by pruning, as is the case with luxuriant growing plants, the growth is economized and a hedge soon formed. In ancient gardening, when topiary work was fashionable and plants were trained and pruned into forms of birds, vases, &c., the hornbeam was largely used and held in high esteem.

A pleasing variety of color may be introduced by forming a hedge of the purple-leaved berberry (*Berberis vulgaris*, var. *purpurea.*) This plant persistently retains its color throughout the summer, and with care can be kept in good shape as a hedge.

For rapid growth, easy propagation, and ample foliage of shining deep-green color, there is no plant superior to the Japan privet (*Ligustrum Japonicum.*) This must not be confounded with the common privet, (*Ligustrum vulgare.*) a small-leaved and much inferior plant. Cuttings of the Japan privet may be inserted at once where the hedge is to be formed. They will root quite as speedily as the easiest rooting willow twig. A splendid shelter or screen, eight feet in height and four feet in width, has been grown in five years from the time of inserting the cuttings. It is almost an evergreen, retaining its foliage even after severe frost. Twenty degrees of frost, in December, has no effect on the foliage, and for at least nine months of the year it is clothed with the richest verdure.

For sheltering orchards, vineyards, or fields, a free-growing plant, of compact habit, should be selected. Such are the Osage orange, white birch, English bird-cherry, honey locust, English maple, European larch, English alder, many of the willows, and the Lombardy poplar. Any of these will, in a few years, afford an efficient shelter. They may be planted from four to six feet apart, and allowed to take their natural habit of growth until they reach a height of ten or fifteen feet. If the tops are then removed or checked, so as to repress upward elongation, they will spread and interlace their lower branches, forming a thick shelter, without the trim, formal appearance of a regularly cut hedge.

It may be safely asserted that no lengthened period of uniform success in fruit culture can be realized in exposed situations, unless a systematic plan of sheltering by belts or hedge rows is introduced; and the time is fast approaching when no person will think of planting fruit trees, or raising fine fruits of any kind, without first preparing for them a thoroughly protected situation.

PECULIARITIES AND ADAPTATION OF TREES.

Trees for street planting.—The silver maple (*Acer dasycarpum*) has always been held in high repute as a shade tree: and although from its frequent use it has, in some sections, come to be considered as a *common* tree, its selection for this purpose is very appropriate. It possesses, in a high degree, the qualities usually sought for by those in treeless local-

ities, being of rapid growth, easily transplanted, perfectly hardy, of an upright rather than a spreading habit of growth, and having foliage not so dense as to impede a free circulation of air, a commendable quality, since a partial shade is more desirable near a building than an impenetrable mass of foliage, which retards evaporation and creates dampness. It is, moreover, a healthy tree, not subject to diseases; neither is it peculiarly preyed upon by insects. It also grows rapidly from the seed. The fruit ripens in June; and, if planted immediately, will produce, in good soil, plants two or three feet in height the same year; neither is it liable to produce suckers, an objectionable tendency peculiar to some free-growing trees.

The sugar maple (*Acer saccharinum*) is one of the most beautiful of all the maples; indeed, few trees of any species can equal it in stateliness and graceful habit; and if to the oak is given the honor of being the king of the forest, we may claim for the sugar maple the title of the queen. No other tree supports an equally massive head of foliage by so slender a stem. It is more compact in its growth than the preceding species, with a greater density of foliage; but its crowning beauty is the superb coloring of the leaves in autumn. For promenades or street planting, it is one of the most desirable of ornamental trees. Large trees are impatient of removal; therefore small-sized plants are to be preferred for transplanting.

The black sugar maple (*Acer saccharinum*, var. *nigrum*) is in no way inferior to the preceding. The foliage is somewhat larger, and slightly downy beneath, changing to deep orange color in autumn.

The American lime or linden (*Tilia Americana*) is a lofty-growing tree, well adapted to planting wide avenues, where it will have ample room to spread. It does not thrive well in crowded cities, being more healthy in suburban localities. It is easily transplanted, and makes rapid growth in loamy soils.

The English linden (*Tilia Europæa*) is a conical-shaped tree, and therefore well fitted for street shade. The flowers are very sweet and attractive to insects, and it has been recommended as a tree of interest to bee keepers. This species of linden is, in some localities, subject to the attacks of borers; but, notwithstanding this objection, many fine specimens may be seen in cities.

The American elm (*Ulmus Americana*) has been in high repute as a street tree; but its liability to injury from insects, which destroy the foliage during summer, greatly diminishes its value, and it is not now so generally planted as formerly. The European elm (*Ulmus campestris*) is more upright in growth than the preceding, but neither of them can be recommended except for wide avenues and localities where they are exempt from the leaf insect.

The English ash (*Fraxinus excelsior*) of all the fine trees of this family, is the best fitted for street planting. In very poor soils it forms a rounded head; but in those which are rather wet than dry it becomes erect and grows with considerable rapidity. It is easily transplanted, and retains its foliage until very late in autumn, but is among the latest to put forth in spring.

The tulip poplar (*Liriodendron tulipifera*) may be claimed to be one of the most unique and beautiful of deciduous trees. It is not surpassed in the beauty of its foliage and flowers, in the columnar massiveness and elegance of its stem, or the general symmetry of its development. In good soil it makes a very rapid growth, as much so as the silver maple; but it is rather difficult to transplant successfully. To insure success it should be prepared by frequent removal while young, so as to secure a

mass of fibrous roots near the stem; or it may be planted in the place desired for its permanent location while very small. In either case it is advisable to prune the branches close back at the time of removal. In transplanting trees from ten to twelve feet or more in height, which have not undergone removal from the seed rows, the only safe mode is to cut off the entire stem near the surface of the ground, lifting the roots with care. Trees treated in this manner have grown to a height of ten feet in four years after removal. When cut down as directed above, a great many shoots will proceed from the base. The most promising of these should be selected as the future stem, the others being cut away. This fine tree is not injured by insects. The foliage is of a bright green during summer, changing to a bright yellow in autumn.

In planting a line of trees in a street or an avenue only one variety should be used. A mixture of kinds in such positions is as much at variance with good taste as the mixture of orders in the columns of a building. As taste improves we may expect to see planting as much under the control of city authorities as the setting of curbstones and the paving of sidewalks are at the present time.

Round-headed trees.—Trees of this form are well adapted to planting private avenues, and short entrance roads through the usually limited lawns of suburban ornamental grounds, combining utility of shade with beauty of development. As single specimens also on lawns, where they will have ample space for growth, their individual features and characteristics will be shown to advantage.

The Norway maple (*Acer platanoides*) forms an extremely dense mass of foliage, of a very dark green during summer, changing to yellow in autumn. The racemes of flowers are ornamental, but should be removed from young trees newly transplanted, as their growth is greatly retarded when the flowers are allowed to remain. The effect of removal frequently throws the plant into a fruiting state. The Norway maple is not of rapid growth, but its compact habit renders it very desirable for planting on small-sized lawns, or for shading walks in the pleasure garden.

The red maple (*Acer rubrum*) is a well-known tree of great beauty, conspicuous for early flowering, enlivening the forest with scarlet and crimson blossoms at the earliest approach of spring. In the fall the leaves change to a bright scarlet, forming a pleasing contrast with the prevailing yellow colors in forest scenery at that season. On account of its not rooting very freely when it is large, small plants should be selected; and, even with these it will be advantageous to prune back the branches closely at the time of removal.

The white ash (*Fraxinus Americana*) is a native species, and forms a noble looking tree, in general appearance resembling the white oak. As an isolated specimen, in rich soils it assumes a symmetrical though not a formal outline. To attain perfection it must not be crowded by other plants: this precaution, however, is applicable to all trees, when their individual habits and natural outline of growth are to be developed.

Yellow wood (*Cladrastis tinctoria*) is a western tree, not much planted in ornamental collections, although few plants are more attractive or so deserving of attention. It is one of the most unique trees for neatly-planted lawns of moderate extent. One of its most striking peculiarities is the regularly shaped protuberance formed at the point of junction of the branches with the main stem. The leaves are pinnated, and change to yellow in autumn. The flowers are shaped like those of the pea, of a yellowish color, and in general aspect resembling the yellow locust.

The horse-chestnut (*Æsculus Hippocastanum*) is a tree with heavy foli-

age and of symmetrical form. It puts forth its leaves early in spring, and is distinguished at that season by its vivid green hue, and superb pyramidal clusters of flowers. This is a poor tree in a poor soil, showing a feeble growth, and losing its foliage before the end of summer; but in a rich and loamy soil it is one of our best ornamental trees, forming a dense shade, and on that account should not be planted too near a dwelling.

The chestnut (*Castanea vesca*) is a well-known tree, famed alike for the value of its fruit and the beauty of its foliage. It is admissible only in extensive lawns. When the soil is deep and rich the foliage becomes large, and of fine, glossy-green appearance; but notwithstanding this, the fruit is produced earlier on poor or rocky soil. The Spanish chestnut closely resembles the native species. Both the foliage and fruit are larger, but the latter is not of so fine a flavor as that of the native plant.

The wild cherry (*Prunus serotina*) is a fine ornamental tree, of a somewhat conical shape when young, but usually becomes rounded as it attains age and size. Its fruit is eagerly sought by birds, and the plant is occasionally introduced into pleasure grounds for their especial gratification. Its merits with regard to foliage, blossoms, and fruit, are sufficient to recommend its introduction into any choice collection of trees.

The ash-leaved maple (*Negundo aceroides*) is one of the finest formed ornamental trees where it has space to develop its natural outline. It is also of very rapid growth, and therefore valuable as a shelter to trees which mature more slowly. Where a sheltering belt of deciduous trees is speedily desired, the negundo may be largely planted, as being of the most rapid growth.

The Osage orange (*Maclura aurantiaca*) has of late years become so widely known as a hedge plant that its merits, as a specimen tree, have been partly overlooked. It is, however, one of the most graceful of the round-headed trees that can be planted on a lawn. The foliage becomes large, and the smooth, hard bark, the outward drooping branches, and the large fruit, combine to render it a desideratum for suburban lawns or ornamental groups.

The Willow oak (*Quercus phellos*) and the Laurel oak (*Quercus imbricaria*) are two desirable lawn trees, not often seen in such situations. When growing isolated in favorable soil, they form dense heads, and their peculiarly narrow, willow-shaped leaves gives pleasing variety in contrast with trees having broad and expansive foliage.

Large-leaved trees.—The great-leaved magnolia (*Magnolia macrophylla*) is a superb tree of tropical appearance, with leaves from eighteen inches to two feet in length, bright green on their upper surface, and silvery beneath. The flowers are large—often eight inches across—and fragrant. This choice ornamental tree, like others of its family, is difficult to transplant, therefore small, healthy trees should invariably be selected.

The catalpa (*Catalpa bignonioides*) is a well-known tree, with ample and rounded foliage, and large panicles of showy white flowers, followed by long pendant pods. A spreading tree, with horizontally twisted branches, it is most effective when planted in groups of four or more trees.

The *Paulownia imperialis* is a rapid-growing tree, somewhat resembling the preceding in general appearance, but its foliage is larger, and the flowers are lilac-colored. In the north, and also in the warmer climates, during severe winters the flower buds are generally destroyed.

Trees with pinnated or finely divided foliage.—The Kentucky coffee tree

(*Gymnocladus Canadensis*) is tall and of close habit, with head somewhat spreading in old specimens. The doubly-pinnate leaves have a fine effect when viewed against a clear sky, having the appearance of delicate net-work. When in a young state it is not very attractive, but as it increases in size the lateral branches become smaller and more numerous in proportion; the leaves also are slightly diminished in size, which improves their appearance.

Honey locust (*Gleditschia triacanthos.*) in consequence of the formidable spines which cover the main stem and branches, presents an aspect somewhat repulsive; but its airy, acacia-like foliage, hanging gracefully on the young shoots, renders it one of the most attractive plants in early summer.

The tree of heaven (*Ailanthus glandulosa*) is a tree with some good and many bad qualities, according to public opinion. It certainly can claim great rapidity of growth, and when fully grown, its heavy pinnated foliage strongly reflects its oriental origin. The female plant is free from the *noisome fragrance* of the male, and produces fruit which is frequently very ornamental.

The black walnut (*Juglans nigra*) is a well-known and useful tree of the largest size, with large, fragrant, pinnated foliage. The European walnut is well worthy of attention on account of the value of its fruit. It is sufficiently hardy, although young plants in vigorous growth occasionally lose the points of their succulent shoots during a severe winter.

The Japan Kolreuteria (*Kolreuteria paniculata*) is a tree of medium size, particularly adapted to lawns, producing large pannicles of yellow flowers, succeeded by ornamental capsules. The foliage turns to yellow in autumn, and at all seasons the plant is attractive.

The silk tree (*Albizzia julibrissin*) is a low-headed spreading tree, possessed of the most graceful foliage. In northern latitudes it is generally killed to the ground by frost; but when spring returns it sends up branches profuse with tropical-looking foliage. It flowers freely in the latitude of Washington, D. C.

The Japan sophora (*Sophora Japonica,*) yellow locust (*Robinia pseudacacia,*) yellow wood (*Cladrastis tinctoria,*) stag-horn sumach (*Rhus typhina,*) and the whole of the family of ashes, may be placed in the list of pinnate-foliaged plants. This form of leaf creates a pleasing variety, and contrasts advantageously with the heavy masses of entire-leaved trees in ornamental grouping. The preceding list embraces some of the most noteworthy ornamental plants of the class. There are many shrubs with leaves of this description, although not individually worthy of particular notice.

Trees with variegated foliage.—These are mainly varieties of species, and are more or less liable, under a bright sun and dry atmosphere, to revert to their original condition. A sheltered and shady locality will be favorable to the permanence of their colors. The following list embraces some of the most available and distinctly marked: The English maple (*Acer campestre*, var. *variegata;*) sycamore maple (*Acer pseudoplatanus*, var. *variegata;*) red maple (*Acer rubrum*, var. *variegata;*) horse-chestnut (*Æsculus Hippocastanum*, var. *variegata;*) white birch (*Betula alba*, var. *variegata;*) European chestnut (*Castanea vesca*, var. *variegata;*) English ash (*Fraxinus excelsior*, var. *variegata;*) European beech (*Fagus sylvatica*, var. *variegata;*) European mountain ash (*Pyrus aucuparia*, var. *variegata;*) European oak (*Quercus pedunculata*, var. *variegata;*) European linden (*Tilia Europæa*, var. *variegata;*) English elm (*Ulmus campestris*, var. *variegata;*) European red-bud (*Cercis siliquastrum*, var. *variegata:*) English bird-cherry (*Prunus padus*, var.

variegata;) Gingko tree (*Salisburia adiantifolia*, var. *variegata;*) Tulip tree (*Liriodendron tulipifera*, var. *variegata;*) Osage orange (*Maclura aurantiaca*, var. *variegata*.

Purple-foliaged trees and shrubs.—European beech (*Fagus sylvatica*, var. *purpurea;*) sycamore maple (*Acer pseudo-platanus*, var. *purpurea;*) English elm (*Ulmus campestris*, var. *purpurea;*) English filbert (*Corylus Avellana*, var. *rubra;*) berberry (*Berberis vulgaris*, var. *purpurea*.)

Trees having cut or laciniated foliage.—White birch (*Betula alba*, var. *laciniata*.)—This is an exceedingly interesting variety of the white birch, of drooping habit: a choice tree for the lawn, where it should be planted as an isolated specimen: its peculiar beauty is lost when grouped with other trees.

European alder (*Alnus glutinosa*, var. *laciniata*.)—Grows well in low situations, or in localities too wet or damp for many other trees. It is very marked and distinct.

European beech (*Fagus sylvatica*, var. *incisa*.)—This remarkable, neat-foliaged plant is seldom seen in collections. It forms a compact mass of fern-like foliage, and is in every respect one of the best plants for a small lawn.

European mountain-ash (*Pyrus aucuparia*, var. *quercifolia;*) sycamore maple (*Acer pseudo-platanus*, var. *laciniata;*) horse-chestnut (*Æsculus Hippocastanum*, var. *laciniata;*) European linden (*Tilia Europæa*, var. *laciniata;*) European oak (*Quercus pedunculata*, var. *laciniata;*) European chestnut (*Castanea vesca*, var. *asplenifolia*.)

Bartram oak (*Quercus heterophylla*, Michaux.)—This unique plant forms one of the most beautiful as well as the most interesting of all the oaks. It is well worthy of introduction into pleasure lawns and parks.

Weeping and drooping trees.—Babylonian willow (*Salix Babylonica*.)—This well-known tree is without a rival in its particular form and style of beauty; of rapid growth, it is one of the best to plant where an immediate effect is desirable. As a background to buildings, or a foreground object to upright growths, it is equally appropriate.

Kilmarnock willow (*Salix caprea*, var. *pendula*.)—When grafted on a good stock ten to fourteen feet in height, this variety becomes one of the most distinct of the hardy weeping plants which we possess. It is frequently worked on low stems, and in consequence much of its beauty is lost. This may be remedied by placing a stout stick to the plant, selecting an appropriate branch, and tying it up as it extends. Side branches will be produced, and, as they depend, a weeping, pyramidal-shaped plant will be secured, much more beautiful than one with a rounded drooping head, as is usually seen.

Camperdown elm (*Ulmus glabra*, var. *pendula*.)—This is also a distinct weeping variety, retaining its drooping habit, and, from its fine large foliage, may be ranked among the best of its class.

Weeping ash (*Fraxinus excelsior*, var. *pendula*.)—When growing luxuriantly, this variety has a tendency to upright growth, which may be obviated by cutting out all the buds that form on the upper surface of the highest placed shoots. There seem to be two varieties having the weeping form, one producing slender branches and more inclined to pendent growth than the other.

European mountain ash, (*Pyrus aucuparia*, var. *pendula*.)

Dwarf cherry (*Prunus pumila*.)—When grafted on a suitable stock, this plant forms a neat, drooping, ornamental tree.

There are many trees that incline to a pendent growth, the points of the branches depending to a greater or less degree as they attain size.

Among the most conspicuous of these may be noted the linden, birch, several elms, poplar, and sophora.

Trees with conspicuous or fragrant flowers.—The dogwood (*Cornus Florida;*) laburnum (*Laburnum vulgare;*) catalpa (*Catalpa bignonioides;*) imperial Paulownia (*Paulownia imperialis;*) red maple (*Acer rubrum;*) yellow locust (*Robinia pseudacacia;*) yellow-wood (*Cladrastis tinctoria;*) horse-chestnut (*Æsculus Hippocastanum:*) magnolias, viz., *Magnolia glauca, M. macrophylla, M. umbrella*, and *M. grandiflora;* Japan sophora (*Sophora Japonica;*) Kolreuteria (*Kolreuteria paniculata:*) Virginia fringe-tree (*Chionanthus Virginica;*) many of the hawthorns (*Cratægus;*) silver bell (*Halesia diptera;*) tulip tree (*Liriodendron tulipifera;*) red bud (*Cercis Canadensis;*) shad bush (*Amelanchier Canadensis;*) American crab-apple (*Pyrus coronaria;*) the linden (*Tilia:*) sassafras (*Sassafras officinale;*) and Mahaleb cherry (*Prunus mahaleb,*) for their fragrance; the European and also the American mountain-ash for their ornamental fruits as well as flowers; and the double-flowering varieties of the peach and cherry form a select list of the most conspicuous hardy flowering trees.

HARDY LIGNEOUS CLIMBING-PLANTS.

There are many situations in small gardens where it is essential to give variety by intricacy of parts, and where the limited space renders its accomplishment impracticable by the ordinary expedient of planting a border of trees and shrubbery, but which may be effectually secured by erecting a screen of trellis-work, to be covered with climbing plants.

To insure some degree of permanency in trellis-work, cedar or locust posts should be used, and covered with laths made smooth and thoroughly painted. What is termed rustic-work, for which many rural improvers seem to have a great *penchant*, is a very expensive ornament, requiring constant care in repairing, varnishing, &c.: and, after all, its rustic beauty is hidden by the twining foliage, which is frequently an improvement to the general effect.

Screens of trellis-work for climbing plants should be constructed with a view to a recognition of architectural effect if in proximity to buildings, divided into panels by projecting piers, and the elevation relieved by moldings. A very appropriate division-wall or fence between the flower and vegetable gardens, or for the purpose of defining any other portions of garden or lawn, may be formed by a low structure, as indicated above, the piers being capped and surmounted with vases. Much of the adaptability and propriety of this arrangement will depend upon its position and the manner in which it is connected with contiguous objects.

The following list comprises the best of hardy climbing plants, with remarks upon their peculiarities and habits of growth:

Trumpet flower, (*Tecoma radicans.*)—This is a robust plant and fitted only for large arbors or for covering walls. It is well adapted to plant against old or mutilated trees, such as are often present in old grounds; and they may be utilized by allowing this climber to cover their nakedness, and soften their rugged points. It produces a profusion of dense clusters of flowers, which are favorite haunts of the humming bird; and it has the valuable property of adhering firmly to walls. It must, however, be occasionally pruned, or it will, from its weight, ultimately break down the overhanging branches.

Golden bignonia, (*Bignonia capreolata.*)—This fine flowering climber is not so commonly planted as its merits deserve. It supports itself by

tendrils, and has great adhering powers; a very choice plant, nearly an evergreen.

Virginia creeper, *(Ampelopsis quinquefolia,)* also called American ivy.—A well-known plant of great beauty of foliage, more especially in autumn. At this season it assumes a crimson shade which deepens into scarlet, producing a striking contrast with evergreen foliage, as may be seen when it takes possession of the red cedar, a tree for which it seems to have a natural partiality. Its delicate tendrils clasp very minute projections, and hence it may frequently be seen profusely covering brick walls. In such situations it is very liable to be blown down during storms, unless care is exercised in trimming, and keeping the branches close to their support. This plant is eminently cleanly and neat, with leaves elegantly formed and of a shining green color during summer. It is also of rapid growth, quite flexible, and readily trained in any desirable position.

The Poison ivy *(Rhus toxicodendron)* is sometimes mistaken for the Virginia creeper, but they can be easily distinguished by the leaf. The poison ivy has its leaflets in *threes*, and the Virginia creeper in *fives*, the leaves of the latter being large, and the leaflets more oblong.

Carolina jasmine. *(Gelsemium sempervirens.)*—Although this plant is tender north of Virginia, yet it succeeds in sheltered city gardens further north. It is one of the most attractive plants, with large, yellow, fragrant blossoms. In cool greenhouses or conservatories, it is an admirable plant for twining around pillars and other supports.

Pipe vine. *(Aristolochia sipho.)*—In rich soils this plant will make a large growth, and cover a great extent of trellis in one season, producing leaves from ten to twelve inches in breadth, and of a vivid green color. In poor soil it is less beautiful in color, as well as diminished in size. It is liable to be infested by a large, black caterpillar, easily destroyed, if carefully watched, before the plant is disfigured. The peculiar shape of the flowers gives it the name of the Dutchman's pipe, to which they have a very strong and remarkable resemblance.

The climbing bitter-sweet *(Celastrus scandens)* is a twining plant of much beauty, especially in autumn, when the orange-colored capsules open, and show the scarlet seed-covers, the raceme-like clusters hanging like small bunches of grapes. It should not be planted near, or at least ought not to be allowed to twine upon, any choice tree or plant. Its tough, twining stem clasps so closely as to interfere with the swelling of the bark: and instances have been observed, where young trees have been so far cut through by the wiry coil of this climber, as to kill the plant.

The Japan honeysuckle *(Lonicera brachypoda)* is a more beautiful vine than the older known Chinese evergreen *(Lonicera Japonica.)* The leaves of this species are somewhat larger, of a bright, shining, or glistening green color: flowers delicate and of sweet fragrance. There is no hardy trailing or climbing plant that can excel this as a covering for veranda pillars, arbors, or trellises. One of the most agreeable beds in a flower garden is a large, oval figure, rounded to a pyramid, (by filling up with soil in the center,) and completely covered with this evergreen, for in such a position it is truly an evergreen, although it will lose its foliage in winter, when exposed on a high trellis. In order to produce the best effect on trellis work, it should be carefully trained, so that the branches may be regularly distributed over the entire surface to be covered. A regular system of winter pruning, which consists in removing all the young growth of the previous year, will keep a neatly covered surface. This surface will be supplied yearly with a graceful growth of

young, drooping, and slender shoots. If the lower branches show diminishing vigor, they may be strengthened by pruning the upper portions of the plant during summer.

Chinese Wistaria. *(Wistaria sinensis.)*—A strong-growing, woody climber, adapted for large trellises or to twining upon trees. Its racemes of flowers are large and fragrant: and it will rapidly cover a large surface, if planted in good soil and favorable situation.

Cocculus, *(Cocculus Carolinus.)*—A native climber, with ornamented fruit, hanging in clusters of a deep red, or nearly scarlet color, and resembling a bunch of the common red currant.

Moonseed, *(Menispermum Canadense.)*—A small-foliaged, delicate climber; producing clusters of black fruit in autumn.

For covering a large trellis or an arbor, in a very short time, our native grapes are among the best plants: and where fruit is not an object of particular consideration, any of the varieties of the frost grape *(Vitis cordifolia)* will be preferable to those of the larger and coarser fox species.

Ivy, *(Hedera Helix.)*—This fine evergreen climber requires to be planted on a northern aspect. It adheres readily to a tree or stone wall, but requires a slight support against a brick structure, at least until it becomes well established. The dryness of our climate prevents it from clasping to walls with that tenacity for which it is famed in Europe. There are many varieties in cultivation, having great diversity of foliage, the most beautiful being variegated with white and yellow.

HARDY HERBACEOUS PERENNIAL CLIMBERS.

Everlasting pea, *(Lathyrus latifolius.)*—A very desirable summer climber, very profuse in flowers: a much-neglected plant.

Chinese yam, *(Dioscorea batatas.)*—This plant, of which so much was expected as a valuable culinary root, has had the misfortune of first being overpraised, and then greatly underrated. It is, however, well worthy of notice for its mere ornamental beauty, as a covering for arbors, &c. It spreads with great vigor, covering a large surface in a few weeks; and, while the roots are perfectly hardy, they possess the additional merit of affording nutritious food. A plant combining these qualities merits attention, and should not be consigned to neglect.

Virgin's bower, *(Clematis.)*—There are many species and varieties of this plant in cultivation: some of them with brilliant flowers, mostly of blue color.

Passion flower, *(Passiflora incarnata.)* and double convolvulus *(Calystegia pubescens.)*—Both of these climbers, although quite desirable in a collection, are inclined to spread and send up suckers from the roots, so that they are apt to become troublesome in some situations.

Climbing fumitory, *(Adlumia cirrhosa.)*—A native plant of very delicate foliage; requires to be grown in a shaded place, where it can find support on a low trellis.

CLIMBING ANNUALS FOR SUMMER DECORATION.

Climbing cobæa, *(Cobæa scandens.)*—A rapid-growing vine, of great value where immediate shade is desired.

Cypress vine, *(Quamoclit vulgaris.)*—A plant with elegant, cypress-like foliage; slender in growth; requires warm soil and exposure to succeed well; flowers of various colors, as scarlet, white, and rose.

Morning-glory, *(Ipomœa purpurea.)*—A well-known plant of much

beauty and great variety; flowers variously colored, but blue prevailing: more or less striped and margined with white.

Balloon vine. *(Cardiospermum halicacabum.)*—A free-growing plant climbing by tendrils; chiefly ornamental on account of its inflated pods, which give to it its common name.

Calampelis scaber.—A plant of rapid extension; foliage thin and scattered; valuable for partial shading; flowers tubular, orange-colored.

Lophospermum scandens.—Equal to the cobæa in rapidity of growth, and valuable where a large surface is to be covered in a short time.

Maurandia Barclayana.—A small-foliaged, graceful-growing plant, with trumpet flowers of various colors; the white variety very delicately beautiful.

Thunbergia alata.—In rich soils this will make a good display; on dry, light soils it burns out in dry weather; flowers orange, white, and yellow, with dark edge.

GRAPE CULTURE.

An approximate exhibit of the extent, progress, and other peculiarities connected with grape culture and wine production has been a long-felt want. Many vague and loose statements, with reference to extent of land planted, and amount of crop, have been put in circulation. Equally unsatisfactory and conflicting opinions are held as to the comparative value of certain soils and locations, the best varieties of the fruit, and the adaptability of certain kinds to particular soils, climates, and localities.

With a view to the collection of statistical information, copies of a circular containing the following list of questions were distributed among the correspondents of this Department and to the principal grape-growers throughout the country:

1. How many acres of vineyard in your county?
2. How many acres actually in bearing?
3. How many tons of grapes were produced the present season?
4. How many pounds were sold or shipped for table use?
5. How many gallons of wine were manufactured?
6. What variety is most popular as a table fruit?
7. What variety is in highest repute as a wine grape?
8. What variety is principally grown?
9. What variety gives the heaviest must on the sugar scale?
10. What varieties are most subject to leaf diseases, and to what extent are they injured?
11. What varieties are most subject to rot, and to what extent?
12. What effect has shelter or protection, of any kind, in preventing leaf diseases?
13. What effect has soil in reference to rot in the berry?
14. What soils, chemically considered, are most favorable to health and vigor of plant, and perfection of fruit?
15. What effects have been observed from mechanical conditions of soils, such as draining, subsoiling, and other cultural operations?
16. What effect has elevation upon the health of the vine? Give results of observations, and opinion as to the proper height above valleys.
17. Has any variety of the foreign grape proved remunerative in vineyard culture?
18. What is the effect of summer pruning, and what method of winter pruning is best?
19. What is the average cost per acre of a vineyard three years old, exclusive of the value of the land?
20. Average yield per acre?
21. How many gallons of wine per acre, on an average of five years?
22. What insects are most injurious to the vine, and what is the extent of the injury, and what remedies have proved efficient?

The collated information from these returns is herewith presented. It is fragmentary, furnishing only contributions toward a complete collection of vineyard statistics; but perhaps as full as could be expected, from the difficulty of obtaining accurate aggregates of figures never officially collected either by national or State authorities, and the necessity of depending mainly upon professional vineyardists instead of our regular corps of correspondents. More complete returns may be obtained hereafter.

From some States the reports are meager, and California, the heaviest producer of all, is not represented. It was considered expedient, however, to include all that have been received, even to those States where only one county has sent returns. The annexed table embraces the answers to questions 1, 2, 3, 4, 5, 19, 20, and 21:

Answers to questions 1, 2, 3, 4, 5, 19, 20, 21.

	Acres in each county.	Acres in bearing.	Tons produced.	Pounds sold.	Gallons manufactured.	Average cost per acre.	Average per acre, pounds.	Average per acre, gallons.	Gallons of wine, average of five years.
	1.	2.	3.	4.	5.	19.	20.	20.	21.
CONNECTICUT.									
Hartford	45	35	20	10,000	15,000	$300	6,000	....	250
GEORGIA.									
Habersham	10	....	....	....	100	....	....	1,500	......
Newton	20	20	10	3,000	1,000	$100	....	300	300
Total	30	20	10	3,000	1,100	100	....	1,800	300
INDIANA.									
Jackson	14	3	....	....	200	$200	....	7,000	......
Madison	20	16	....	....	....	....	....	....	......
Montgomery	5	5	2	....	50	....	....	6,000	......
Newton	1	......	....	....	....	....	....	....	......
Park	2	2	2	1,000	12	....	....	....	......
Porter	30	4	6	4,000	500	....	....	....	......
Ripley	5	5	....	....	....	200	200	....	300
Scott	1	......	....	....	....	....	....	....	......
Spencer	1	1	....	....	160	500	250	....	300
Vigo	20½	18	41	5,000	6,000	400	300	7,000	......
Wayne	50	50	25	....	....	70	....	....	......
Total	149½	104	79	10,000	6,922	1,370	750	20,000	600
IOWA.									
Dallas	5	5		....	....	....	7,000	....	......
Dubuque	25	20	10	....	540	$100	3,000	....	160
Linn	16	8	10	10,000	....	225	6,000	....	†
Mitchell	10	7	2	....	....	400	....	....	100
Monona	2	1	*	....	....	175	....	....	......
Polk	100	60	4	5,000	200	400	5,000	*	200
Van Buren	20	10	....	4,000	2,000	....	6,000	....	*
Total	178	111	26	19,000	2,740	1,600	27,000	....	360
ILLINOIS.									
Adams	80	60	‡	....	....	....	....	....	......
Alexander	1	½	....	....	....	....	....	....	......
Calhoun	50	38	....	2,000	1,250	$200	....	....	......
Carroll	18	6	5	5,000	500	....	3,000	....	......
Champaign	15	3	3½	3,500	....	150	....	....	......
Clinton	97	77	2½	2,000	11,000	....	....	....	......
Coles	1	½	....	2,000	....	....	8,000	....	......
DeWitt	7	4	6	4,000	200	200	6,000	....	300
Edwards	4	4	....	....	200	....	....	....	......
Edgar	10	5	....	....	200	....	....	....	150
Effingham	10	5	6	8,000	200	100	8,000	....	......
Fayette	25	12	3	4,000	....	....	....	....	......
Greene	8	8	....	....	....	275	1,000	....	......
Hancock	1,562	900	1,174	444,000	158,600	350	3,000	....	250
Henry	15	7	11½	....	200	400	....	....	......
Iroquois	20	7	12	10,000	50	250	8,000	....	......
Jersey	96	46	50	14,000	6,000	335	5,000	....	250
Knox	40	25	15	26,000	1,000	200	1,300	....	......
Kankakee	40	7	....	10,000	1,000	500	....	....	......

* Failure from grasshoppers. † From wild grapes. ‡ Injured badly by hail.

Answers to questions 1, 2, 3, 4, 5, 19, 20, 21—Continued.

	Acres in each county.	Acres in bearing.	Tons produced.	Pounds sold.	Gallons manufactured.	Average cost per acre.	Average per acre, pounds.	Average per acre, gallons.	Gallons of wine, average of five years.
	1.	2.	3.	4.	5.	19.	20.	20.	21.
ILLINOIS—Cont'd.									
Lee	6	1	......	......	......	$350	......	......	......
Logan	1	1	3	4,000	100	200	6,000	?	......
Macon	60	20	......	......	2,000	......	......	......	......
Macoupin	30	3	6	10,000	......	......	4,000	......	......
Marion	50	10	12	20,000	1,000	225	......	200	......
McDonough	20	15	5	8,000	......	......	......	......	......
McHenry	25	5	10	11,000	50	250	8,000	......	......
McLean	90	45	25	40,000	......	100	6,000	......	......
Mercer	40	20	......	......	......	650	......	......	......
Monroe	175	130	......	500	35,000	300	5,000	......	300
Montgomery	10	3	6	6,000	......	75	......	......	......
Pope	14	7	8	......	800	300	......	......	300
Rock Island	22	5	1½	......	144	200	......	......	......
Scott	25	7	12	......	2,000	400	8,500	......	......
Shelby	3	1	......	......	168	......	......	......	......
Tazewell	20	10	......	......	100	300	4,000	......	......
Warren	20	12	38	30,000	375	200	6,000	......	550
Woodford	6	3	5	1,500	425	650	500	......	400
Total	2,726	1,400	1,420	665,500	221,912	7,260	91,300	200	2,500
KANSAS.									
Leavenworth	35	24	30	40,000	1,000	$300	3,000	......	450
KENTUCKY.									
Jefferson	200	180	......	......	1,000	$1,000	1,500	......	250
MASSACHUSETTS.									
Norfolk	20	......	......	......	......	......	......	......	......
Middlesex	74	38	15	10,000	2,000	$400	7,000	......	700
Total	94	38	15	10,000	2,000	400	7,000	......	700
MICHIGAN.									
Monroe	35	10	9	8,000	1,075	$197	......	......	......
Van Buren	10	3	3	......	500	......	......	......	......
Total	45	13	12	8,000	1,575	197	......	......	......
MINNESOTA.									
Ramsey	5	1	2	1,000	80	......	......	......	......
MISSISSIPPI.									
Tishomingo	25	15	......	......	......	......	......	......	......
MISSOURI.									
Buchanan	100	25	150	150,000	11,000	$275	500	7,000	......
Clark	15	10	5	5,000	400	......	......	......	......
Clinton	15	3	1	......	60	......	......	......	......
Cole	9½	5	......	500	50	......	......	......	......
Daveiss	......	......	......	......	100	......	......	......	......
De Kalb	1½	¾	......	......	......	......	......	......	......
Gasconade	650	650	600	10,000	95,000	600	350	......	550

Answers to questions 1, 2, 3, 4, 5, 19, 20, 21—Continued.

	Acres in each county.	Acres in bearing.	Tons produced.	Pounds sold.	Gallons manufactured.	Average cost per acre.	Average per acre, pounds.	Average per acre, gallons.	Gallons of wine, average of five years.
	1.		3.	4.	5.	19.	20.	20.	21.
MISSOURI—Cont'd.									
Holt	14	5	.....	.....	500	$175	.....	12,000	.....
Howard	25	12	24	.....	3,500	150	200	.....	200
Jefferson	375	90	135	62,000	[illegible]	[illegible]	650	[illegible]	.....
Lewis	26	12	.....	.....	1,500	130	.....	.....	700
Linn	15½	5	.....	.....	.....	350	.....	.....	.....
Montgomery	100	75	10	.....	10,000	400	5	6,000	.....
Phelps	7	½	.....	500	50	120	.....	.....	.....
Pike	20	8	11½	14,000	781	60	.....	3,000	.....
Ray	20	10	8	4,000	800	500	.....	.....	.....
Scotland	10	8	.....	1,000	50	.....	.....	.....	.....
St. Louis	105	60	.....	.....	.....	500	.....	.....	.....
Sullivan	20	10	.....	.....	25	90	.....	.....	.....
Total	1,5[illegible]	944½	944½	247,000	102,9[illegible]6	4,54[illegible]	[illegible]	3[illegible]	1,450
NEW JERSEY.									
Burlington	50	40	.....	.....	.....	.....	.....	.....	.....
NEW YORK									
Clinton	3	2	3	3	.....	.....	.....	.....	.....
Chautauqua	1,000	350	700	800,000	20,000	$275	5,000	.....	350
Livingston	90	30	30	16,000	500	.....	.....	.....	.....
Niagara	240	55	125	160,000	4,000	140	6,000	.....	500
Ontario	1,500	1,000	.....	.....	.....	250	4,500	.....	.....
Orange	300	200	200	300,000	5,000	300	1,500	.....	450
Steuben	4,000	2,500	6,000	1,000,000	200,000	400	6,000	.....	400
Ulster	250	200	250	400,000	4,000	200	5,000	.....	500
Wayne	90	50	30	40,000	400	75	4,[illegible]	.....	300
Total	7,473	4,387	7,338	2,716,003	234,[illegible]	1,730	3[illegible]	.....	2,500
NORTH CAROLINA.									
Beaufort	.....	.....	.....	.....	4,000	.....	700	.....	.....
Craven	200	.....	.....	.....	1,000	$40	.....	.....	450
Total	200	.....	.....	.....	5,000	40	700	.....	450
OHIO.									
Ashland	50	10	.....	.....	.....	$300	.....	.....	.....
Coshocton	.....	.....	.....	.....	.....	300	4,[illegible]	.....	.....
Cuyahoga	5,600	4,000	4,200	4,800,000	300,000	325	2,500	.....	200
Delaware	20	13	.....	.....	.....	.....	.....	.....	.....
Erie	2,000	1,500	.....	.....	50,000	200	3,000	.....	300
Fairfield	150	23	20	12,000	1,500	200	4,000	.....	300
Hamilton	1,200	1,200	.....	.....	.....	300	.....	.....	20
Highland	20	20	.....	.....	.....	500	.....	200	75
Jefferson	40	30	12	.....	1,500	400	.....	.....	.....
Lake	102	42	.....	.....	.....	400	4,000	.....	350
Lawrence	35	25	.....	.....	2,000	300	.....	325	300
Licking	77	25	30	.....	1,000	300	6,000	.....	.....
Mahoning	35	12	20	.....	.....	400	4,000	.....	.....
Meigs	3	.....	.....	.....	.....	150	1,650	.....	200
Miami	400	300	.....	.....	25,000	100	.....	180	150
Montgomery	50	50	.....	.....	1,000	185	.....	.....	.....
Muskingum	25	15	5	.....	.....	.....	.....	.....	.....
Portage	20	10	.....	.....	100	44	.....	200	250
Scioto	.....	.....	.....	.....	.....	450	.....	600	.....
Shelby	5	5	.....	.....	400	200	.....	.....	200

Answers to questions 1, 2, 3, 4, 5, 19, 20, 21—Continued.

	Acres in each county.	Acres in bearing.	Tons produced.	Pounds sold.	Gallons manufactured.	Average cost per acre.	Average per acre, pounds.	Average per acre, gallons.	Gallons of wine, average of five years.
	1.	2.	3.	4.	5.	19.	20.	20.	21.
OHIO—Cont'd.									
Stark	10	8	11½		445	$350			
Washington	54	33	12		642		2,000		150
Warren	85	55	20	1,700	425	125	3,200		100
Total	10,069	7,387	4,330¼	4,813,700	384,012	5,479	34,350	1,600	2,595
PENNSYLVANIA.									
Armstrong	28	18		2,500					
Dauphin	15	8			100	$130			
Erie	1,000	550	1,000	1,400,000	34,000	175	3,000		200
Franklin	10	5							
Luzerne	28	25	30			115	3,000		
Perry	10	6							
Total	1,091	612	1,030	1,402,500	34,100	420	6,000		200
SOUTH CAROLINA.									
Barnwell	400	400						150	150
Newberry	100	75	50		1,000	$100	2,000		400
Total	500	475	50		1,000	100	2,000	150	550
TENNESSEE.									
Maury					500				
WISCONSIN.									
Dane	2	10							
Fond du Lac	8	3							
Total	28	13							

The returns to questions 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 22, are in substance as follows:

Question 6. What varieties are most popular as table fruit?—Arkansas: *Catawba, Delaware.—Connecticut: Concord, Delaware.—Delaware: Concord.—Georgia: Herbemont, Scuppernong.—Illinois: Concord, Delaware, Catawba, Iona, Hartford Prolific, Isabella, Diana.—Indiana: Concord, Catawba, Delaware, Hartford Prolific, Isabella, Diana.—Iowa: Concord, Delaware, Hartford Prolific, Clinton, Creveling.—Kentucky: Concord, Ives, Delaware.—Kansas: Delaware.—Missouri: Concord, Catawba, Delaware, Hartford Prolific, Isabella, Diana, Iona.—Minnesota: Delaware.—Michigan: Concord, Delaware.—Massachusetts: Concord, Delaware.—New Jersey: Concord, Isabella, Delaware.—North Carolina: Scuppernong, Catawba.—New York: Delaware, Iona, Catawba, Isabella, Concord, Salem, Diana, Adirondack, Hartford Prolific, Rebecca, Max-

* The varieties are named in order according to their estimated value.

atawny.—Ohio: Concord, Catawba, Delaware, Isabella, Iona, Rogers's No. 15.—Pennsylvania: Concord, Isabella, Catawba, Iona, Hartford Prolific, Diana, Israella.—South Carolina: Scuppernong, Catawba, Isabella, Lenoir.—Tennessee: Catawba, Isabella, Concord.

Question 7. *What varieties are in highest repute as wine grapes?*—Connecticut: Delaware, Concord.—Georgia: Scuppernong.—Illinois: Concord, Norton's Virginia, Catawba, Clinton, Delaware, Ives, Iona, Hartford Prolific, Herbemont.—Indiana: Catawba, Delaware, Ives, Concord, Norton's Virginia, Isabella, Iona, Clinton.—Iowa: Concord, Delaware, Clinton, Catawba, Norton's Virginia, Rogers's No. 4.—Kentucky: Catawba, (in old vineyards,) Ives, Delaware.—Kansas: Delaware.—Missouri: Norton's Virginia, Concord, Catawba, Delaware, Herbemont, Clinton, Ives.—Minnesota: Concord.—Michigan: Delaware, Concord.—Massachusetts: Concord, Delaware.—New Jersey: Delaware, Clinton.—North Carolina: Scuppernong.—New York: Delaware, Iona, Catawba, Isabella, Concord, Clinton, Oporto.—Ohio: Catawba, Delaware, Concord, Ives, Norton's Virginia, Clinton.—Pennsylvania: Catawba, Delaware, Isabella, Concord, Clinton, Iona, Ives.—South Carolina: Scuppernong, Clinton.—Tennessee: Maury, Mauch.—Wisconsin: Isabella, Catawba.

Question 8. *What varieties are principally grown?*—Arkansas: Catawba, Concord.—Connecticut: Hartford Prolific, Concord.—Delaware: Concord.—Georgia: Scuppernong.—Illinois: Concord, Catawba, Clinton, Hartford Prolific, Delaware, Norton's Virginia, Isabella, Herbemont, Iona, Diana, Ives.—Indiana: Concord, Catawba, Isabella, Delaware, Ives, Norton's Virginia, Clinton, Diana, Hartford Prolific, Iona.—Iowa: Concord, Clinton, Norton's Virginia, Catawba, Rogers's No. 4, Delaware.—Kentucky, (old vineyards,) Catawba; (new vineyards,) Ives, Concord, Delaware, Diana, Norton's Virginia.—Kansas: Concord.—Missouri: Concord, Norton's Virginia, Catawba, Delaware, Clinton, Herbemont, Isabella, Iona.—Minnesota: Concord, Northern Muscadine.—Michigan: Concord.—Massachusetts: Concord.—New Jersey: Concord, Isabella.—North Carolina: Scuppernong.—New York: Isabella, Delaware, Concord, Catawba, Diana, Iona, Clinton, Salem, Hartford Prolific.—Ohio: Catawba, Concord, Isabella, Delaware, Ives, Norton's Virginia, Clinton, Hartford Prolific, Diana.—Pennsylvania: Concord, Isabella, Catawba, Iona, Diana, Hartford Prolific, Clinton, Creveling.—South Carolina: Scuppernong, Catawba.—Tennessee: Catawba.—Wisconsin: Concord, Delaware.

Question 9. *What varieties give the heaviest must on the sugar scale?*—Connecticut: Delaware.—Georgia: Pauline, (98,) Herbemont, (93,) Catawba, (85,) Scuppernong, (70.)—Illinois: Delaware, Norton's Virginia, Catawba, Rulander, Concord, Herbemont, Clinton.—Indiana: Catawba, Delaware, Ives, Concord.—Iowa: Delaware, Norton's Virginia, Catawba, Concord, Clinton.—Kentucky: Norton's Virginia.—Kansas: Delaware.—Missouri: Norton's Virginia, Delaware, Concord, Catawba.—Minnesota: Delaware, Iona.—Michigan: Delaware.—Massachusetts: Delaware, Clinton, Concord.—North Carolina: Scuppernong.—New York: Delaware, (103,) Iona, (101,) Diana, Clinton.—Ohio: Delaware, (110,) Catawba, (95,) Norton's Virginia, (98,) Concord, (81.)—Pennsylvania: Delaware, (100,) Iona, (100,) Isabella, Catawba.—South Carolina: Catawba, Pauline.

Question 10. *What varieties are most subject to leaf diseases, and to what extent are they injured?*—Arkansas: Isabella, badly; Concord, slightly.—Connecticut: All varieties more or less except Ives.—Georgia: Pauline, Herbemont, and all the varieties of the *Vitis Labrusca*.—Illinois: Catawba, Delaware, Clinton, Isabella, Rebecca, Diana, Iona, Ives, Hartford

Prolific, Maxatawny, Israella, Creveling.—Indiana: Catawba, Delaware, Isabella, Cuyahoga, Iona, Israella, Concord, Diana.—Iowa: Clinton, Catawba, Diana, Isabella, Rogers's Hybrids, Allen's Hybrid, Iona.—Kentucky: Rogers's Hybrids, Delaware, Clinton, Tokalon, and all varieties if pruned in summer.—Kansas: Delaware, Catawba; about three-tenths.—Missouri: Catawba, Delaware, Isabella, Iona, Clinton.—Michigan: Isabella, Iona, Israella.—Massachusetts: Delaware, Creveling, Israella, Diana Hamburg; Creveling, four-tenths to five-tenths.—New Jersey: Delaware, Creveling, Rebecca, Iona, Diana, Allen's Hybrid, Maxatawny.—New York.—Delaware, five-tenths; Adirondack, four-tenths; Walter, three-tenths; Allen's Hybrid, three-tenths; Isabella, two-tenths; Concord, one-tenth; Diana, one-tenth; Rebecca, one-tenth; Iona, one-tenth; Israella, one-tenth.—Ohio: Catawba, Delaware, Iona, Isabella, four-tenths to five-tenths; Rogers's Nos. 3, 4, 15, three-tenths to five-tenths; Allen's Hybrid, four-tenths; Israella, three-tenths; Clinton, Iona, Diana, one-tenth to three-tenths. Always most injurious to plants that are overloaded with fruit; prevents ripening of wood, and weakens the vitality of the plant.—Pennsylvania: All varieties are subject to leaf blight, sometimes to the extent of seven-tenths of the foliage, except Concord, Hartford Prolific, and Northern Muscadine.—South Carolina: Catawba, Isabella.—Tennessee: Isabella, very badly.—Wisconsin: Little or no disease.

Question 11. *What varieties are most subject to rot, and to what extent?*—Arkansas: Clinton, Isabella.—Connecticut: Diana.—Georgia: Catawba, Isabella, six-tenths.—Illinois: Catawba, seven-tenths to entire; Isabella, five-tenths to eight-tenths; Clinton, four-tenths to six-tenths; Creveling, five-tenths to seven-tenths; Diana, five-tenths; Taylor's Bullet, three-tenths; Tokalon, three-tenths; Iona, four-tenths; Rebecca, three-tenths; Concord cracks.—Indiana: Catawba, three-tenths to eight-tenths; Isabella, three-tenths to eight-tenths; Diana, three-tenths to five-tenths; Concord, two-tenths.—Iowa: Catawba, five-tenths to eight-tenths; Diana, four-tenths; Isabella and Clinton, three-tenths; Concord, one-tenth.—Kentucky: Rogers's Hybrids, Iona, Catawba.—Kansas: Catawba rots badly in wet seasons.—Missouri: Catawba, Isabella, Iona, Tokalon.—Michigan: Catawba, Isabella.—Massachusetts: Diana; very little in other varieties.—New Jersey: Isabella in wet locations only.—North Carolina: Catawba.—New York: Catawba, three-tenths to four-tenths; Concord, one-tenth to two-tenths; Diana and Delaware on low, alluvial lands are subject to rot to a great extent.—Ohio: Catawba, three-tenths to eight-tenths; Isabella, three-tenths to six-tenths; Israella, three-tenths; Diana and Iona, three-tenths; Concord, one-tenth to three-tenths.—Pennsylvania: Catawba and Isabella, very badly, frequently to the extent of eight-tenths.—South Carolina: Catawba, Warren.—Tennessee: Isabella and Catawba, very badly after bearing two or three crops of fruit.—Wisconsin: Allen's Hybrid, three-tenths.

Question 12. *What effect has shelter or protection, of any kind, in preventing leaf diseases?*—Arkansas: Saunders's sheltered trellis effectually prevents leaf diseases.—Connecticut: Very little effect.—Georgia: Always fair when grown in trees.—Illinois: Favorable wherever tried; even slightly-covered trellis insures against mildew; protection will insure fair crops in the most unfavorable seasons.—Indiana: Beneficial where tried.—Iowa: Good where it has been tried.—Kentucky: A beneficial effect to all tender-leaved varieties.—Missouri: Where tried has exerted a favorable influence.—Massachusetts: Beneficial by increasing the temperature.—New York: Favorable where it does not prevent a free circulation of air.—Ohio: Vines trained against buildings and on covered

trellises are free from leaf diseases; instances are known of successful culture of uncertain varieties under shelter, successive crops for thirteen years having been raised.—South Carolina: Most excellent effect; prevents leaf diseases.—Tennessee: Vines protected by projecting eaves or copings always do well.

Question 13. *What effect has soil in reference to rot in the berry?*—Illinois: Low, wet soils almost invariably produce rot in the berry; rich lands also seem to induce rot in the berry.—Indiana: Wet and rich soils are the prevailing causes of rot in the berry.—Iowa: Undrained clay soils cause rot.—Kentucky: Stiff, retentive subsoils, keeping water near the surface, produce rot.—Kansas: Very rich soils cause rot in the grape.—Missouri: Rot in the berries is very rare, and is seen on rich or heavy clay soils only.—Massachusetts: Not liable to rot on dry soils.—New Jersey: In wet seasons and on wet soils we have rot in the berries.—North Carolina: The rot is frequently disastrous on rich or retentive soils.—New York: Only on low grounds and wet subsoils.—Ohio: Heavy wet soils are extremely pernicious, and thought to be the primary cause of rot; drained soils, even clays, are almost entirely exempt.—Pennsylvania: The rot is most destructive on undrained, heavy clays, but is also induced by over-manuring and enriching the soil.—South Carolina: We seldom escape rot in the berries, on heavy, damp soils.

Question 14. *What soils, chemically considered, are most favorable to health and vigor of plant, and perfection of fruit?*—Arkansas: A reddish clay soil, intermingled with sand, is the most congenial, so far as experience confirms; on pure clays the crop has failed.—Connecticut: A good depth of limy, loamy soil is best.—Georgia: Soils containing alkaline phosphates, and considerable humus, are most productive, and maintain healthy plants.—Illinois: Silicious and calcareous soils are well suited; also gravelly clay soils, if somewhat rolling on the surface; clay subsoils are very good, if not too wet; especially so if they contain some iron and lime.—Indiana: Grapes do well on clays if properly drained and limed; also very fairly on gravelly and sandy soils when properly worked.—Iowa: The vines seem to do equally well either on silicious, calcareous, or gravelly soils, where the last is not too poor or light. Shales are very good. Clayey soils produce the richest fruit, but sandy soils the greatest amount of vine.—Kentucky: Soils containing much oxide of iron seem to favor the rot.—Kansas: A sandy clay soil is best for grapes.—Missouri: The most favorable soils are those of a silicious and calcareous nature, containing magnesian limestone, with potash and phosphates; clay soils are very good, but they must be drained.—Michigan: The earliest and sweetest fruit is produced on clay soils, but sandy soils give the largest and best-looking fruit.—Massachusetts: Where the growing season is short, a dry sandy soil is preferable.—North Carolina: A light sandy loam gives best results.—New York: Calcareous and aluminous soils abounding in phosphates; shaly soils are always good.—Ohio: Calcareous and aluminous soils, well drained; also rotten shales.—Pennsylvania: Calcareous soils in combination with iron; shaly and silicious soils are very well adapted.—South Carolina: The varieties of *Vitis estivalis* prefer silicious soils; the varieties of *Vitis vulpina*, those of an aluminous character; and the varieties of *Vitis rotundifolia* do equally well in either; as a general rule, light soils are best if supplied with lime and potash.—Wisconsin: A loose limestone soil is perhaps the most favorable; sandy clay soils are also good, but very stiff clays are not so profitable.

Question 15. *What effects have been observed from mechanical conditions of soils, such as draining, subsoiling, and other cultural operations?*—

Arkansas: Subsoiling and trenching show marked results for good.—Connecticut: Draining is indispensable in order to get the grape to grow in originally wet soils.—Illinois: Draining, trenching, and good culture are necessary; the soil should be well pulverized and manipulated before planting.—Indiana: Draining seems indispensable in most soils; subsoiling and good culture generally are always attended with marked results.—Iowa: Deep plowing, in conjunction with draining and subsoiling, prevents rot to a very great extent.—Kentucky: Draining and subsoiling pay well.—Kansas: We find the best results on drained soils, and shallow after-culture.—Missouri: The yield of fruit is largely increased by draining, trenching, and subsoiling.—Massachusetts: Draining is useful.—North Carolina: The products are greatly improved by proper stirring and culture of the soil.—New York: Draining and subsoiling are of essential benefit, making the growth more certain, and preventing injury from drought.—Ohio: Very dry soils are vastly improved by trenching; draining is indispensable in stiff clays, and subsoiling favorable; good clean culture will always be attended by best crops.—Pennsylvania: Under draining is always attended with good results in tenacious soils.—South Carolina: Draining is absolutely necessary in clay soils; subsoiling is useful in aluminous lands, but of no use in silicious soils.—Tennessee: Draining and deep culture, especially on poor soils, are of great benefit.—Wisconsin: Deep culture is necessary in dry summers.

Question 16. *What effect has elevation upon the health of the vine? Give results of observations, and opinion as to the proper height above valleys.*—Arkansas: Other things being appropriate, we prefer low situations, because they are sheltered from heavy storms.—Connecticut: No difference if the ground is dry in the valleys.—Illinois: Elevated rolling lands are decidedly the best, but elevation is not so important when near large bodies of water; near small streams, or in valleys distant from water, an elevation of from one hundred and fifty to two hundred and fifty feet is much preferable; very liable to freeze in low grounds.—Indiana: An elevated position is always the best; grapes are healthier, with much less disposition to rot, even in wet seasons.—Iowa: An elevation of fifty to two hundred feet above streams has proved best.—Kentucky: There is no question but that elevated sites are to be preferred, where the air can circulate freely, and be protected from slight frosts.—Kansas: Elevations of fifty to one hundred feet above valleys, with grounds sloping to the south, are the best.—Missouri: Elevations of from three hundred to four hundred feet above water-level have proved the very best, for health and value of products.—Minnesota: The best vines are those cultivated on elevations one hundred to two hundred feet above the river.—Massachusetts: Side hills (of no great elevation) with southern slopes are the most favorable; northern slopes and low frosty hollows must be avoided here.—North Carolina: The Scuppernong grape does best in low lands, but other varieties succeed only on elevations; on the mountain sides, where we are exempt from occasional late and early frosts, failure has never been known; in low valleys they are destroyed by blight and rot.—New York: Our best vineyards are on considerable elevations, from fifty to four hundred feet above the valley. On these high lands we are not subject to early frosts in autumn, and the vine is healthier generally than in low grounds.—Ohio: Elevations are considered good, but opinions differ as to height; some prefer being within range of fogs; fifty to three hundred feet above creeks and small streams exempts from early fall frosts, and vineyards are generally more healthy; where there are large bodies of water, elevation seems of but little consequence.—Penn-

sylvania: Elevations of from two hundred to four hundred feet are safer in early and late frosts, and both the fruit and the vines are superior to the production of low grounds.—South Carolina: The best grape region is that above the frost-belt on the mountain slopes: this is clearly indicated by the fact that a diseased grape leaf or berry has never been seen on these elevated lands.—Tennessee: We find decidedly the best grapes on elevated positions.—Wisconsin: Elevations are subject to destructive wind-storms.

Question 17. *Has any variety of the foreign grape proved remunerative in vineyard culture?*—The returns uniformly express a negative answer to this question.

Question 18. *What is the effect of summer pruning, and what method of winter pruning is best?*—Arkansas: Judicious summer pruning assists in developing the fruit; any system of renewal is good for winter pruning.—Connecticut: Vines that are allowed to run all summer without pruning invariably yield large crops.—Delaware: When summer pruning is judiciously performed, it has a tendency to increase the quantity and quality of the fruit, and also tends to promote maturity of growth.—Georgia: We find summer pruning injurious.—Illinois: All known methods of pruning are more or less practiced. Summer pruning is considered hurtful, according to its severity. Cases are cited of severe summer pruning causing a loss of half of the crop.—Indiana: Summer pruning should be limited; it is injurious if severe. All methods of renewal and spur methods of winter pruning are practiced.—Iowa: Summer pruning is injurious, if it involves the removal of much of the foliage. A moderate pinching of the points of fruiting shoots checks growth and improves the fruit. The renewal and other systems of winter pruning are practiced.—Kentucky: On the whole, summer pruning is considered injurious, and should be abandoned.—Kansas: Summer pruning should be strictly confined to pinching out the points of shoots, and not removing them entirely.—Missouri: Summer pruning is practiced to a moderate extent. The winter pruning takes place in November. All modes are practiced.—Michigan: Summer pruning is deemed hurtful when carried to any considerable extent. The winter pruning is on the renewal system.—Massachusetts: Very little summer pruning. Winter pruning on the spur system.—North Carolina: Summer pruning severely injures, and sometimes kills the vine in this locality.—New York: Summer pruning is injurious, except so far as to check the growth of rampant shoots, or remove superfluous wood. All systems of winter pruning are practiced, but the renewal mode is preferred.—Ohio: Summer pruning is injurious as an unqualified system, but is favorable to the extent of removing superfluous buds, and checking over luxuriant growth. Many systems of winter pruning are practiced, but the renewal system is preferred. The system of horizontal arms with spurs has resulted in comparative failure.—Pennsylvania: Moderate summer pinching is favorable to increase in the size of fruit, but is likely to increase the present at the expense of subsequent crops. Winter pruning is varied, both the renewal and the spur system in various modifications being practiced.—South Carolina: Summer pruning is not practiced. The renewal system has been adopted in winter pruning.—Tennessee: No summer pruning done.—Wisconsin: Summer pruning is found to be beneficial when done with judgment. Winter pruning is done in November.

Question 22. *What insects are most injurious to the vine, and what is the extent of the injury: and what remedies have proved efficient?*—Arkansas: The leaf roller is somewhat troublesome on all varieties, except the Scuppernong and Clinton.—Connecticut: The thrips is sometimes very in-

jurious.—Delaware: A small curculio, the name of which has not been determined, is very destructive.—Georgia: No trouble from insects.—Illinois: The leaf folder, thrips, borer, and curculio are occasionally found in vineyards. Shaking and hand-picking are the only known remedies for the last named.—Indiana: Insects are not troublesome, although rose bugs occasionally devastate the young fruit bunches.—Iowa: The leaf roller and thrips are the principal insect enemies. The first named can be destroyed by dusting with hellebore powder.—Kansas: The thrips is sometimes seen, but not to any great extent.—Missouri: The rose bug, thrips, and some other insects are to be seen, but not to any great extent.—Minnesota: No injury from insects.—Massachusetts: Rose bugs are troublesome.—New Jersey: Rose bugs sometimes destroy the crops.—North Carolina: The Scuppernong grape is exempt from all insect enemies; other varieties are sometimes injured.—New York: The grape beetle, thrips, rose-bug, and caterpillar appear. Whale-oil soap and dusting with lime are good preventives.—Ohio: A worm that eats its way from one berry to another does considerable injury. The thrips is most destructive upon thin and smooth-leaved varieties. They have been prevented by washing the vines with a mixture of soft-soap and sulphur in the fall, after the decay of the foliage; also by fumigating with tobacco smoke on their first appearance. Lime and sulphur sprinkled on the leaves are also effective. The rose bug, steel-blue beetle, and curculio are occasionally troublesome.—Pennsylvania: Various insects make their appearance, but none of them are very injurious, except the thrips in some dry season.—South Carolina: The thrips is occasionally troublesome.—Tennessee: No insect of any moment.—Wisconsin: The thrips to a small extent.

RECAPITULATION.

States.	Number of counties reported.	Total acreage planted.	Total acreage in bearing.	Grapes produced, (tons.)	Grapes sold, (pounds.)	Wine manufactured, (gallons.)	Average cost per acre.	Average product per acre, (pounds.)	Average product of wine per acre, (gallons.)	Average product of wine per acre for five years, (gallons.)
Arkansas										
Connecticut	1	45	35	20	10,000	15,000	$300 00	6,000		250
Delaware										
Georgia										
Illinois	37	2,711	1,515	1,415½	615,500	224,412	285 20	5,072	200	312½
Indiana	11	149½	104	81	10,000	6,922	274 00	6,666⅔	250	300
Iowa	7	178	111	26	19,000	2,740	320 00	6,200		180
Kentucky										
Kansas										
Missouri	19	1,528¼	992	944½	237,000	163,116	341 50	6,900	483⅓	540
Minnesota	1	5	1	2	1,000	80				
Michigan	2	45	13	12	8,000	1,575	197 00			
Massachusetts	2	91	38	15	10,000	2,000	400 00	7,000		
New Jersey	1	50	40							
North Carolina	2	200				5,000	40 00		700	450
New York	9	7,473	4,387	7,338	2,322,000	234,250	247 14	4,571		416⅔
Ohio	23	10,009	7,387	4,330½	4,813,000	384,012	274 00	3,475	320	199¾
Pennsylvania	6	1,101	612	1,030	1,402,500	34,100	140 00	3,000		200
South Carolina	2	500	475	50		1,000	100 00	2,400	150	275
Tennessee						500				

According to the above reports, the most popular varieties for table use are, 1st, Concord; 2d, Delaware; and, 3d, Catawba. Those in highest repute for wine, are, 1st, Delaware; 2d, Concord; 3d, Catawba and Scup-

perimong in the southern States. The varieties principally grown are the Concord and Catawba, but the newer varieties are rapidly being disseminated, and their respective merits will be tested in a few years. On the must scale the Delaware shows the greatest uniform amount of sugar, next the Iona; the Catawba and Norton's Virginia are also favorably mentioned in this respect.

In regard to mildew and other leaf diseases, no variety appears to be entirely exempt; Concord, Ives, Hartford Prolific, and Northern Muscadine appear to suffer the least, and it is probably owing to this exemption from severe leaf injury that these varieties are so prominent.

Rot in the berry is almost as universal as leaf blights, nearly all the varieties being liable under certain conditions. If any exceptions are made they refer to the family of summer grapes, the cultivated varieties of which are the Elsinboro, Norton's Virginia, Lenoir, Cunningham, Herbemont, &c.; these appear to be noted for their freedom from rot. Old vines are also more generally liable to rot than those in young plantations.

Shelter from dews and other atmospheric changes is considered advantageous in modifying leaf diseases. It has long been observed that vines growing under the partial protection of the overhanging eaves of a building, also those allowed to ramify unmolested on the branches of trees, are generally exempt from injury. Covered trellises seem to exert a similar influence.

The effect of soil with reference to rot in the berry seems to be very decided. Soils that retain water, as undrained clays, are very likely to rot the fruit of grapes, more especially when the plants are over four or five years old. Very rich bottom lands are also conducive to this disease. Wet seasons are more fatal than dry on any soil, the primary cause appearing to be an excess of water in the soil.

The chemical constitution of the soil does not seem to exert any very marked influence on the growth of the vine; clayey soils produce the richest fruit, as also the earliest ripe; the latter, however, depending upon the moisture of the season; success evidently depends rather upon its physical qualities. The conviction is gradually gaining ground that all grape soils should be artificially drained, unless they actually rest on an extremely porous strata; deep culture, or rather deep preparation of the ground, is also strongly recommended in connection with draining, the two operations being of much benefit only when simultaneously performed; draining being of little value unless the soil is deeply cultivated, and deep culture of but little value unless the land is drained.

The effect of elevation upon the health of the vine is considered as favorable: the reports are nearly unanimous on this point. Not only are high lands more favorably disposed to drainage facilities, but the greater immunity from late spring and early fall frosts is of vast importance. Localities contiguous to large bodies of water are pre-eminently favored in this respect, but small streams in sheltered valleys have an injurious rather than a beneficial influence.

The returns are entirely unanimous in regard to the failure of the foreign grape in vineyard culture, a fact which should be considered by those who are still experimenting with foreign wine grapes east of the Rocky Mountains.

Summer pruning, so far at least as it involves the removal of any great amount of foliage, is generally abandoned as injudicious, and tending to positive injury. If performed early in the season, and only to the extent of partially checking the growth of certain shoots, more particularly those that are bearing fruit, it is beneficial; but to remove a quan-

tity of healthy foliage at any period during the active growth is certain to result in injury.

The modes of winter pruning are rather indefinitely described, and various modifications of renewal and spur pruning are practiced. The renewal method seems to have the preference, although it is evident that very widely varying practices are included in the term.

No serious injuries from insects are reported. The thrips is most troublesome, but no practical and at the same time effectual mode of destroying them has been made apparent.

CULTIVATION OF THE PEANUT.

Though the peanut has been cultivated in Virginia to some extent from a remote date, it is only since the war that the crop has become of primary importance in the section of the State peculiarly adapted to its production. The greater part of Eastern Virginia was by turns occupied by both of the contending armies; and as nearly every farmer raised peanuts enough for his family, and some to spare, their merits became extensively known among the soldiers; so that when the armies were disbanded a knowledge of them was carried to every part of the country. It is doubtless to this cause, more than to any other, that we are to ascribe the extraordinary impulse given to their culture within the last few years. So rapid has been its extension that the crop of each successive year has been threefold greater than that of the year preceding, and at prices fully maintained. The crop of 1868 in Virginia is estimated to have aggregated about three hundred thousand bushels, the average price of which was about $2 75 per bushel. Such enormous profits in the present depressed condition of our agriculture are well calculated to keep up the same ratio of increase for 1869, so that the product might be safely estimated at a million of bushels if it were not that many of the new planters have embarked in the business without an adequate knowledge of the conditions necessary to success.

The preparation of the soil, however, is shrouded in no mystery, while the subsequent culture is almost as simple and scarcely more expensive than that of corn. This may be inferred from the fact that some planters put as much as a hundred acres in peanuts, and not a few from thirty to fifty acres, in addition to other crops. To attain the best success the planter should not be lacking in any one essential, and in order, therefore, to treat the subject intelligently, it will be presented under several heads.

SOIL.

Any soil that can be put in a friable condition, and kept in that state, will produce peanuts; but that which is best adapted to their growth is a light, gray soil, without being very sandy. The color of the pods always partakes of the color of the soil; and as the brightest pods always bring the most money, so the gray land is to be preferred. When harvested they are perfectly clean, scarcely a particle of soil adhering to them. Not so with red or chocolate-colored lands. They leave a stain on the pods, of which they cannot be divested even by washing—a practice frequently resorted to for the purpose of getting a fancy article. When taken to market the bright nuts will command from ten to fifteen cents more per bushel than the brown, though equal in all other respects. The gray soil is therefore to be selected when there is freedom of choice, but the brown soil, when of the right texture, is equally productive.

In choosing a site for planting, reference should be had to the crop of the previous year. Peanuts require a clean soil; they will follow any hoed crop to advantage, with the exception perhaps of sweet potatoes. Corn land is generally preferred. In tide-water Virginia much of the

land was heavily marled in former years, and whenever this is the case an important and perhaps the chief requisite to success has been already provided. The peanut will not fruit except on a calcareous soil. The vines may grow with the greatest luxuriance, covering the whole ground, but in the absence of lime or marl the pods do not fill: they turn out to be nothing more than what is popularly called "pops." If, then, the land has not been previously marled or limed, it will be necessary to apply say a hundred and fifty bushels of marl, or fifty bushels of lime, to the acre. The kind of lime chiefly used of late years is burned oyster shells, which may be had in abundance in all the large towns. It is applied in either of several ways, according to the convenience of the planter, and with about equally good effect. If there is any choice, spreading broadcast is perhaps the best, to be done before the land is plowed; in which case the quantity should be about fifty bushels to the acre. A favorite mode, where a large surface is to be planted, is to strew the lime in the furrow over which the bed is to be raised for planting. In this case a less quantity will answer, by reason of its being more concentrated—say twenty bushels. Other planters, again, who are hurried in their work, spread the lime over the beds after the crop is planted, at the rate of about thirty bushels to the acre. Either mode is attended with good success; but wherever it is practicable to have a choice of land that has been sufficiently marled or limed in former years, and preserved by judicious culture, the best results are found to follow. In such cases the yield not unfrequently reaches a hundred bushels to the acre. Last year the writer was told by a planter of the highest character that on twelve acres of such land as has been just described he sold fourteen hundred bushels of nuts of prime quality, besides saving an ample supply for seed. The product ranges from the quantity stated down to twenty-five or thirty bushels to the acre, according to the skill, or want of skill, of the planter—a fair average of the whole being estimated at fifty bushels.

Few persons make peanuts part of a regular system of rotation, but the pre-eminent success of a gentleman who has followed the plan is worthy of special reference. Mr. Henry M. Butts, of Southampton County, Virginia, has for years pursued the following course: The lot intended for peanuts, say next year, has been seeded in stock peas this year, the vines to be plowed in some time in September. The vines afford a great quantity of vegetable matter, which becomes thoroughly decomposed by the time for planting the crop. When the season for planting is at hand, the ground is replowed and laid off, and ten bushels of lime and a hundred and fifty to a hundred and seventy-five pounds of superphosphate strewn in the furrows to be ridged over. The year following peanuts the land is planted in sweet potatoes, with a liberal dressing of stable manure. The third year it is laid down in stock peas again, to be followed by peanuts as before, always repeating the lime and superphosphate. The crops of Mr. Butts averaged, one year with another, not less than a hundred bushels to the acre. Last year from ten acres he sold thirteen hundred bushels of prime peanuts, entirely exempt from "pops," and worth three dollars per bushel.

CULTIVATION.

Having selected the ground, it is to be plowed with a one-horse plow in March or April to a depth not exceeding four or five inches. The advantages of shallow culture will be apparent from the fact that the peduncles continue to penetrate the earth until a firm bed is reached on

which to deposit the nut: and the still further fact of the increased facility afforded in harvesting, as will appear when we come to treat of that branch of the subject.

About the 10th to the 20th of May is the time for planting. If the land is thin and needs manuring, open furrows three feet apart, and strew in a hundred to a hundred and twenty-five pounds of Peruvian guano, or from a hundred and fifty to two hundred pounds of superphosphate of lime. The former is generally used, because of the greater certainty of getting a pure article, but nothing can be better than the latter when well prepared. The furrow is then to be ridged over and the whole surface thrown into three-feet beds, which should be reduced to within two or three inches of the general level of the field. Then mark off the rows, and at distances of eighteen inches plant two seeds, covering them an inch to an inch and a half deep—not more.

In ten days to two weeks, according to the weather, the young plants begin to come up. As it is very important to get a good start, the missing hills should be replanted at the earliest moment. It is the custom of some planters to put an extra quantity of seed in every fourth or fifth row, to furnish plants for transplanting, if needed; if not needed, they can be thinned out.

As soon as the grass makes its appearance give a light plowing, throwing the earth from the vines, and following with the hoe, thoroughly removing all the grass from the row. Plow again as soon as the grass reappears, this time using a double shovel or cultivator, and the hoe as before directed. If the season should prove to be very wet, a third working may be necessary, making use of the cultivator and hoe again.

Next comes the time for laying by, the vines having extended nearly half way across the space between the rows. This is done by running a mold-board once in the middle between the rows, and drawing the earth up to the rows with the hoe, care being taking not to cover the vines and to disturb their position as little as possible, as the fruit will now be forming. It will be necessary also to guard against making the bed too high. When there is grass in the row it must be pulled up by hand. Soon after this the vines will cover the whole ground, and repress every other growth, unless it may be a chance weed that escaped notice at the former working.

HARVESTING.

The time for harvesting the crop is from the 15th to the 30th of October, immediately after the first frost. When the crop is forward, or when it is an object to get a portion of it early in market, the operation may be commenced in the latter part of September: but the longer the vines continue to grow, the greater will be the number of sound pods. Select a time when the weather is settled and favorable, and with three-pronged hoes loosen the vines along the rows. Hands follow the digger, pull up the vines, shake the dirt from them, and leave them in the same place. In dry weather they will be sufficiently cured in two days to be shocked. Showery weather, though it may somewhat delay the curing, does no injury.

One of the advantages of shallow culture becomes apparent in harvesting. When the fruit is deposited only a few inches below the surface, the vine is detached from its position with little or no loss: when the depth is greater, the stems or pedicels are liable to be broken off.

In shocking, provide stakes seven feet long, made sharp at both ends;

then lay two fence rails on the ground as a foundation, but with supports underneath to afford free access to the air. The stakes are stuck in the ground at convenient intervals between the rails, the stacks built up around them, and finished off by a cap of straw to shed the rain. The diameter of the stack is made to conform to the spread of a single vine.

After remaining about two weeks in the stack the picking should be begun, taking off none but the matured pods. These are to be carried to the barn, and prepared for market by completing the drying process, and then fanning and cleaning.

The most tedious part of the work is the picking. An expert discriminates at a glance between the mature and immature pods, but cannot pick more than two and a half or three bushels per day. A machine to perform the operation would be a most valuable invention. Unless the management in the barn is carefully conducted, there is great danger, where there is much of a bulk, that the peas will become heated and mouldy. The condition in which the early deliveries are often received at market renders this caution quite necessary. In fact, there is as much slovenliness in the handling of this crop as there is in regard to any other; perhaps more, for the reason that so many inexperienced persons engage in the culture every year. Until the pods are thoroughly seasoned, the bulk should be frequently stirred and turned over.

A certain classification, in respect to quality, obtains in peanuts as in every other article of agricultural produce. The descriptive terms in general use are "inferior," "ordinary," "prime," and "fancy;" but these are not so definite as to admit of no intermediate grades. Assuming *prime* to be the standard, and that the prime are \$2 75 per bushel, then *inferior* will be worth, say, \$1 to \$1 50; *ordinary*, \$2 to \$2 50; and *fancy*, \$3. Seed peanuts always command an extra price, ranging from \$3 25 to \$3 50. These were the current prices for the crop of 1868.

VARIETIES.

There are two very distinct varieties of the peanut, known respectively by the names of the *Virginia*, and the *Carolina* or *African*. The diversity between them, however, does not amount to a specific difference, the chief characteristics being that the one has a large pod and bean, and the other a small one. The Virginia is cultivated almost exclusively for eating, while the Carolina is principally used for the manufacture of oil, which cannot be distinguished from olive oil, and is, accordingly, sold as such. The standard weight of the Virginia peanut is twenty-two pounds to the bushel; that of the Carolina twenty-eight pounds. In the markets they are always sold by weight.

SEED.

A matter of primary importance is to provide seeds of good quality for planting; and in order to be assured of their excellence, the planter should either raise them himself, or buy them of a person on whose fidelity he can rely. If, after the vines are dug and they are lying in the field, they should be exposed to frosty weather, the germinating principle would be destroyed or impaired. As a merchantable article, however, their value is not at all affected. Neither should the nuts become the least heated or mouldy; nor should they be picked off the vines while wet, or before they are thoroughly cured. It is obvious, therefore, that the most careful attention is requisite in this matter. Previous to planting, the pods should be carefully shelled and every

faulty bean thrown out; not even the membrane inclosing the seed should be ruptured. It takes about two bushels of peanuts in the pod to plant an acre.

PROFITS.

The relative profits of peanuts and other leading crops of the district of country in which they are severally grown may be determined with a near approximation to accuracy. Assuming that the average yield of cotton to the acre is half a bale, or two hundred and twenty-five pounds, and that it is worth twenty-five cents a pound, the aggregate proceeds would be $56 25. An average crop of tobacco does not exceed six hundred pounds, nor the average price $10 per hundred; the gross proceeds would, therefore, amount to $60. An average crop of peanuts is fifty bushels per acre, which may be put at $2 50 per bushel, aggregating $125; so that it appears that at one-half the price, or one-half the product, the peanut is as profitable as either cotton or tobacco. So far as regards the expense of preparation and culture, the difference between peanuts and cotton is inconsiderable; but the picking of the cotton is by far more tedious and laborious than gathering the peanuts. As to tobacco, the crop is never off the hands of the planter, and the cultivation is the most expensive of the three, leaving, therefore, less clear profit.

CONCLUDING REMARKS.

The peanut crop is justly considered exhausting, but not more so, it is believed, than either of the others with which we have compared it. Planters who have been long engaged in the culture say that the same ground may be planted for a succession of years, provided the vines are restored to the soil, and a moderate application is annually made of guano or other fertilizer. Cotton, under a similar system, may be planted on the same land for an indefinite period without diminution of product.

The vines of the peanut make a large quantity of very nutritious provender, which is eaten with avidity by cattle. If the crop is dug before frost, it is equal in value to any other forage plant. As the pods are picked off, the vines should be placed under shelter, secure from the weather.

On account of the profit of the crop, it has taken the place of tobacco to a considerable extent in places where the soil is adapted to it. This is the case in the large tobacco-growing counties of Amelia, Nottoway, Halifax, and Brunswick, besides others of less note. How far north the culture may be extended to advantage is at present a matter of conjecture; but in the tide-water district of Maryland, and also in Delaware and the southern part of New Jersey, it well deserves a trial.

THE POTATO.

HISTORY AND HABITS.

The potato (*Solanum tuberosum*) is a native of the table-lands of the Andes of South America. Centuries ago it was found by travelers growing wild in Chili, at Cuzco in Peru, at Quito in Ecuador, and in the forests of Bogota in New Granada, 8,694 feet above the level of the sea. Potatoes have been cultivated at Quito from time immemorial, and are among the finest in the world. This city is situated on an extensive plain, at an elevation of 10,233 feet. The mean temperature of the climate throughout the year is about sixty degrees Fahrenheit, and varies from this but little at any particular season. The country has the appearance of perpetual spring. There are no sudden changes from heat to cold, no violent storms of rain and wind. The land is refreshed by distilling dews and gentle showers.

The soil of these table-lands, which are the uplifted beds of an ancient ocean, is generally composed of disintegrated rocks and shells, of the detritus of the mountains, and of vegetable mold, and belongs to the geological formation of the secondary or the tertiary period. It is, therefore, light, porous, and friable, and contains large proportions of sand, lime, and vegetable substances. It is also naturally well drained, though retentive of sufficient moisture, and, from its elevated and airy location, is cool and moderately dry.

Such is the native home of the potato, where it grows spontaneously, renewing itself from year to year from its tubers and seeds. It retains the verdure of its foliage unimpaired throughout the entire season, and when its tubers and seeds are fully matured, it dies, not of any injury from external influences, but because its period of life has terminated.

From this brief history of the habits of the potato, the following principles may be deduced: 1. That the location for its culture should be elevated and airy. 2. That the climate should be temperate, not subject to extremes of heat and cold, nor violent storms of wind and rain, having a mean temperature of about sixty degrees. 3. That the soil should be light, well drained, and composed of the proper proportions of sand, lime, and vegetable mold.

These principles lie at the foundation of the successful cultivation of the potato. If they are regarded, good crops may be expected; if they are neglected, the result will be poor crops, degeneracy, and disease of the plant. Although the potato is of tropical origin, (tropical in its latitude though not in climate,) and has its favorite locality, in which it will grow with certainty and in perfection, yet such is its adaptability that it may be grown, by careful culture, with tolerable success, from Patagonia to Labrador, and from the Cape of Good Hope to Iceland.

DISEASES.

There are difficulties to be encountered in the cultivation of the potato, when removed from its native locality, which are unavoidable, and can be overcome only in part by a thorough knowledge of its origin and habits. The most formidable of these are the diseases of rust, curled

leaf, and rot. The first two are only the incipient stages of the latter, and the causes and remedies are the same in each.

It is generally believed that *debility* is a predisposing cause of the potato rot, and usually, if not always, preliminary to its attacks. It may be induced in various ways:

1. *By planting small and imperfectly matured tubers.*—Tubers may be small in consequence of the feeble constitution of the plant, or because they were formed late in the season, and, therefore, had not sufficient time to attain full size and maturity. It is a law well established in the vegetable kingdom, and also in the animal, that like produces like. By this it is not meant that the offspring will be exactly like the parent in every particular, but simply that it will more resemble it than any other variety. If, then, we plant a tuber which is small and the result of feeble growth, we cannot, by any principle of reproduction, expect anything, as a general result, but a small and feeble offspring. This may not always be fully realized at once, but sooner or later it will come.

In the case of imperfectly matured tubers it is well known by all that potatoes, when used before they are ripe, are unpalatable, hard, and watery. These qualities result principally from the absence of starch, which, according to the analysis of Professor Payen, made with seven varieties of the potato, constitutes about seventeen parts out of the twenty-six parts of the whole solid or dry matter contained in the tuber—seventy-four parts of the tuber being water. The starch, when converted into sugar by the process of germination, furnishes food for the young plant in the early stages of its growth, and before it has thrown out roots by which it may draw any nourishment from the earth.

Now, if the tuber does not contain a proper amount of starch, in consequence of its imperfect maturity, the young plant cannot get the necessary nourishment, and of course must be feeble and stinted during the period of its growth; and this shock to its constitution cannot be overcome by any amount of fertility of soil from which it may afterwards derive its food. Hence imperfection and debility will be the result, and a foundation will be laid for future disease. A remedy for this debility may be found by yearly selecting and planting full-sized and perfectly matured tubers.

2. *By planting tubers cut very small.*—Tubers are often cut into very small pieces, containing perhaps only one or two eyes at most. It is obvious that pieces so small can contain only a very small quantity of starch for the nourishment of the young plant. It must, therefore, struggle through this critical period of its existence in a starved condition, and we cannot reasonably suppose that it will ever be able to overcome this want of "a good start" at the commencement of life, by any subsequent cultivation, however good it may be. "Small potatoes," says C. E. Goodrich, "and those cut very small, are certainly very objectionable in a physiological point of view. The sprouts, until they are well out of ground, and their leaves expanded, draw all their food from the mother potato. If this is small, or has a great many eyes in proportion to its size, it cannot throw up strong shoots."

And further, admitting that the pieces are sufficiently large to contain all the starch necessary for healthy germination and growth, yet in many instances they suffer a partial decay before germination, while lying in the ground, and the starch is changed from its healthy condition, in consequence of the absorption of water and noxious substances, through the lacerated organs of the cut tubers.

The tuber is a thickened portion of a branch, growing out of the stalk

under ground, and having the power of retaining life for a time after the parent plant has perished. It is not a root. If a shoot of the common currant bush should thicken at the end and swell into a tuber, its woody substance being changed into nutritious matter, and its buds retained on the outside, it would precisely correspond with the tuber of the potato. The eyes of the potato are only the buds of the branch.

The buds of a shrub or a tree are connected with the woody tissue and pith of the branch, by the medullary rays, so that a circulation is constantly kept up between the interior and the surface. The buds (eyes) of the potato are connected with the interior of the tuber in a similar manner; and if the rootlets are cut the functions of the organs are impaired, and they cannot perform their offices of absorbing nutrition from the tubers as they would if they had not been injured, and, therefore, the young plant is weakened. It is true that the potato has naturally such vigor of constitution that it will grow even from a peeling not more than an eighth of an inch in thickness, but it must be apparent to every careful observer that, with such deficiency of support, it could not long maintain its health.

To guard against the danger of decay of the tuber in the ground before germination, it is covered with a coating which is nearly impervious to all fluids, so that the matter which is contained within is carefully preserved from contact with all substances which would unfit it for supplying healthy nourishment for the young germ which it is intended to support. "The fact is," says C. E. Goodrich, "the potato has a less permeable skin than any other culinary root. This impermeability forbids the transmission of ordinary liquids through it; hence it is the last root to wither in the sun and the last to absorb moisture. The withering of potatoes in ordinary cases in spring is the result not of transpiration of their juices, but of their loss by germination."

From these statements it appears evident that the greatest health and vigor of the plant are secured by adopting the course which nature pursues in reproducing the plant in its native locality, or by planting full-sized and perfectly matured tubers whole. "The custom of planting cut potatoes," says Professor von Martius, "instead of whole ones, should in no case be adopted, as without doubt it has exerted an influence in the deterioration of the race."

3. *By long cultivation of the same variety.*—It is generally believed that, by long cultivation of any variety of the potato, it at length becomes less prolific, and is weakened in its whole constitution. Although the fact of deterioration is admitted, there is much difference of opinion with regard to its cause. If the cause could be perfectly known, a very important step would be taken toward finding a remedy by which the debility might be removed.

Some persons suppose the reason of the deterioration to be, that the elements of the soil have been exhausted, and that the potato really becomes weakened for want of proper food; a part of the deterioration is also attributed to bad cultivation. It is said, in reply, that this is no doubt true to a certain extent, but that a change of locality and culture will not restore its original vigor. "I have in several instances," says T. A. Knight, "tried to renovate the vigor of old and excellent, nearly expended varieties of the potato, by change of soil and mode of culture, but I never in any degree succeeded."

In addition to this, it is contended that the deterioration is owing really to exhaustion of the vital energies of the plant, by reason of age; that all created beings, whether plants or animals, have a beginning, a maturity, and an end; and, although the end may sometimes be much

deferred by various artificial means, as good culture, &c., yet death is inevitable. John Townley thinks that the potato raised from the seed is in its prime or full maturity from the fourth to the tenth year, and after this it generally declines, and will, in the course of years, "run out," and finally become extinct. The power of propagating the potato from the tuber appears to be only a temporary device, by which a desirable variety may be continued beyond its annual period of life for a few years, or until other good varieties may be produced and perfected from the seeds.

It is asserted, further, that the renewal of a plant by a bud or a branch, as in the cultivation of the potato from the tuber, is only a continuation of the same organization, or old variety; that the earth in the case of the tuber, and the stock in the case of grafting a branch upon it, "can give nutriment only," and "not new life;" and that it is the seed, which has been influenced by the pollen, that originates a new plant which differs from all that have been created before it or will be created after it, being endowed with a vital principle peculiar to itself, and which no other plant of the same species, or any other species, can impart or perpetrate beyond a certain limited period of life. "The culture of the potato constantly from the tubers," says C. E. Goodrich, "and almost never from the seed, added to the carelessness with which that cultivation has been conducted, has certainly tended to enfeeble it."

Admitting that this view is correct, one remedy at least for the debility must be found in raising new varieties from the seeds of healthy plants. If vigorous varieties cannot be found at home, they must be obtained from their native locality. The seeds should be sown in beds or boxes like tomato seeds, in early spring, and then transplanted into well-prepared soil, where they may mature their tubers. It is recommended to set the stems deep, or about one-third in the ground, that they may not dry up, and that the tubers which grow from them may be properly protected. Some tubers of tolerable size will be formed the first year, and of full size the second. Only a few will prove worthy of being cultivated.

New varieties may also be produced by cross-breeding, which consists in fertilizing the pistils of the flowers of a desirable variety by the pollen of the stamens of another variety, the qualities of which we wish to impart to the former. From the seeds produced by the fertilized plant new varieties may be grown possessing, in some degree, the qualities of both, and some may be better than either. It should be remembered, however, that all new varieties are not equally hardy, some, from a natural weakness of constitution, being more inclined to rot than others, and therefore inferior, in this respect, to some older varieties; but these cases are exceptional. If the practice of renewing the potato from the seeds at proper intervals should be adopted, the debility arising from long cultivation of the same variety would be avoided.

4. *By cultivating in soils not containing the elements necessary for its growth.*—It is found, by an analysis of the solid or dry matter of the tuber of the potato, that about forty-four parts out of one hundred are carbon; and of the one hundred parts of the ash of the tuber, about forty-eight parts are potash and twenty-one parts phosphates. It will be seen, therefore, that the elements which form a large portion of the solid part of the potato are carbon and potash. We have also previously shown that carbon and lime abound in the soil of the table-lands where the potato grows wild.

If these elements are wanting in the soil in which we desire to cultivate the potato, (and this can be ascertained by analyzing it,) they must be

supplied by artificial means, as the only proper remedy for weakness induced by a deficiency of nutritive elements. Carbon may be supplied in abundance from decayed vegetable substances, as leaves, turf, and muck; potash may be found in ashes, lime, and gypsum, and the phosphates in bones. All experience proves that these substances, combined in proper quantities with sand and loam, form an admirable soil for the growth of the potato; and preparing the soil in this way constitutes an important part of good cultivation.

5. *By excessive stimulus from strong and concentrated manures.*—It is a fact of common observation that plants which are subjected to high cultivation do not ripen and consolidate their tissues so thoroughly as those of more moderate growth. Fruit trees cultivated in rich gardens, and making large growth of wood, are certainly not capable of enduring so great climatic changes, without injury, as those which grow in poorer soils.

The case is the same with the potato. The tubers are inflated and watery, in consequence of a deficiency of starch, which should have been elaborated in the leaves, and properly prepared for plant growth; the organs are overworked and surcharged with stagnant matter, and the whole plant feels the delibitating influence. This effect may not appear in the first or the second year, or indeed in many years; but, like the abuse of the human system by excesses of any kind, it will surely appear at some time. This anxiety to raise large crops, and to work the plant beyond its capacity by excessive stimulus, is very injurious, and will, in the end, destroy it. Moderate stimulus produces a firm texture and vigorous constitution.

6. *By effect of climate, or sudden alternations of heat and cold, and of wet and dry weather.*—Few plants, even of those which are native, will endure great extremes of climate without injury. The potato, although a very hardy plant, is in some respects tender. The effect of sudden cold after great heat is to paralyze the organs which elaborate the sap for the nourishment of the plant, and unfit them for performing the offices in the vegetable economy for which they were designed.

The pores (stomata) are the breathing passages of plants, and are found on the leaves and stems in great numbers. Through these the superfluous water taken up by the roots is eliminated. In wet weather they are open, and in dry nearly closed, to prevent too great evaporation. Too much wet after hot and dry weather, or excessive heat after drenching rains, has an effect very similar to too great cold. The spongioles of the roots, after heavy rains, absorb large quantities of water containing the nutritive elements very much diffused. The leaves and stems also absorb additional quantities, containing little or no nutrition. The elaborating organs become gorged with fluid, and the tissues tender. If a sudden transition to great heat and dryness occurs at this time, the pores are closed and evaporation is checked. The fluids are retained in a stagnant condition in the tissues, the elaborating organs are obstructed, the leaves become pale and sickly, and finally decomposition and disease ensue. The effect here described is often seen after heavy rains, blackening the foliage of the potato in every part.

Climatic influences cannot, of course, be entirely overcome, but the most natural remedy for the disease, resulting from want of adaptation of climate, is to cultivate this crop in that portion of the year which combines in the greatest degree, in any given locality, the conditions of uniformity of a proper temperature, serenity of atmosphere, and the requisite amount of moisture. From what we have learned of the habits of the potato, it appears that an average temperature of about sixty degrees

is most congenial to its growth. Boussingault says it can be cultivated with the best success, in respect to quantity, quality, and freedom from disease, the soil being the same, in places in which the mean temperature during the season of growth ranges between fifty-six and sixty-five degrees. The period must vary, of course, with the different localities in which it is cultivated.

The following table gives the most favorable portions of the year for the growth of the potato in different sections of the country, with the mean temperature of the same. Also, the mean for each month and for the year, together with the yearly range of the thermometer, or the difference between the warmest and the coldest day of the year.

Different localities.	Mean for Dec.	Mean for Jan.	Mean for Feb'y.	Mean for Mar.	Mean for April.	Mean for May.	Mean for June.	Mean for July.	Mean for Aug.	Mean for season	Mean for year.	Range for year.
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
New Orleans, La.....	63.47	62.45	58.57	68.95	......	......	......	......	......	62.03	73.44	61.00
San Francisco, Cal....	......	......	51.69	56.19	59.62	57.16	......	......	......	56.16	57.43	62.00
Sacramento, Cal.....	......	......	49.04	56.43	62.33	66.50	......	......	......	58.57	60.02	67.00
Knoxville, Tenn	......	......	......	53.33	54.83	67.13	72.47	......	......	61.94	57.69	85.50
Philadelphia, Penn....	......	......	......	......	45.53	61.20	71.20	77.11	......	63.77	53.46	99.00
Harrisburg, Penn ...	......	......	......	......	45.71	61.88	71.58	77.11	......	64.07	52.42	103.00
Oswego, N. Y........	......	......	......	......	......	53.01	59.66	73.33	67.82	62.45	45.56	111.00
Augusta, Me..........	......	......	......	......	......	56.57	61.46	71.38	66.59	64.00	44.77	116.00

It will be seen, by examining the table, that the winter season is chosen, at New Orleans, for cultivating the potato. In consequence of the small yearly range of the thermometer, and the cool and uniform temperature of this season of the year, potatoes of the best quality may be raised with entire exemption from the rot. This is not, however, a desirable locality for their cultivation as an article of commerce, the great heat making it difficult to preserve them.

At San Francisco and Sacramento the thermometric changes are small, in consequence of their southern position and the ameliorating influence of the winds, which diminish the cold in winter and the heat in summer, thus producing a uniformity of temperature and serenity of atmosphere very favorable to the potato. Mr. Cronise, in his recent work on California, says that the potato-rot is unknown about these places.

As we go northward the yearly range of the thermometer increases, and the changes from heat to cold become greater and more violent; but isothermal lines do not always correspond with latitude; as at Knoxville it is colder than at Sacramento, although the latter is further north. These variations may be caused by the difference of elevation above the sea, or by the effect of winds. In Grand Traverse County, Michigan, between Lake Michigan and Lake Huron, the temperature is so much softened by the lakes and the winds that the potato-rot has never prevailed in that section, although it is common in places in the same latitude around it.

At Harrisburg, Oswego, and Augusta, the range is still greater; and in these places the rot has prevailed extensively. At the North, planting early in spring is found to afford, as a general rule, more favorable conditions than at a later period; but in all these places some years will be found more favorable than others, because of the presence or absence of the conditions necessary to the healthy growth and maturity of the crop.

Another cause of the potato-rot is generally supposed to be *parasitic fungi*, which usually, perhaps not always, follow rather as a consequence of previous debility of the plant.

The fungi are a very extensive class of plants which, in common language, receive the names of toadstools, mushrooms, rust, mildew, smut, bunt, puff-balls, &c. They are found in all parts of the globe, but are most abundant in moist, temperate latitudes. The division of plants to which they belong is called *Cryptogamia*, or flowerless plants, and their seeds are usually called spores. These spores or seeds are very minute, and can be studied only when subjected to a good microscope. They begin to germinate by sending out numerous filamentous rootlets, composed of a succession of very small cells, which perform the office of roots in supporting the plant in an erect position, and supplying it with nurishment. These rootlets are called the *mycelium*. They also send up stems (*stipes*) of various shapes, according to the class to which they belong. The *Botrytis infestans*, more recently called the *Peronospora infestans*, is one of the most destructive of the fungi that cause the potato-rot. It has the form of a spreading tree, bearing some three thousand ovoidal spore-cases (*acrospores*) on the ends of the branches, somewhat resembling, when taken collectively, clusters of grapes, and hence its generic name *Botrytis*. Each of these acrospores contains six to sixteen seeds called *Zoöspores*.

The seeds of the fungi, which are contained in the spore-cases, usually have a brown color, like fine dust, and are almost infinite in number. A single plant is said sometimes to produce millions, so small and light as scarcely to be affected by gravity. They cover everything around them—earth, plants, and animals. The air is filled with them, and they wait only for a state of the atmosphere favorable to their growth to seize upon every object within their reach. They live principally upon decaying substances, but the living do not always escape them.

The conditions best adapted to their growth are, first, a debilitated or morbid state of the plant; and, secondly, a proper degree of heat, moisture, and electric influence to induce germination. They do not germinate readily, and the conditions must be very nicely balanced to insure germination at all. They frequently remain inert for a long time, and, when the conditions are complete, fall upon plants like an epidemic, and after a time disappear almost entirely. Such may, perhaps, sometimes have been the case in their attacks upon the potato. Long-continued warm, damp weather, often causes them to appear in great numbers; but a single day of dry weather will arrest their progress.

They mature with wonderful rapidity. Puff-balls sometimes grow six inches in diameter in a single night. Certain species have been found growing on the surface of iron that had been heated in the forge only a few hours before. They have also been found growing on the surface of glass. The *Peronospora infestans* matures in a few days, sometimes in fifteen to eighteen hours even, when conditions are most favorable to its growth, and scatters its seeds by thousands and tens of thousands, to prey, with each successive brood, from day to day, upon the expiring plant.

The seeds are supposed to enter the pores (*stomata*) of the leaves and stems, and also to be taken up by the spongioles of the roots, and carried along in the circulation of the sap through the plant. They take root in the cellular tissues of the stems and leaves, stop up the pores with their roots, prevent the proper elaboration of the crude sap, and exhaust large portions for their own support, besides probably exerting a deleterious chemical influence on the plant. That the seeds of this fungus are capable of destroying the potato has been demonstrated by Dr. De Bary, who mixed some of them in a drop of water and applied them to the leaves and tubers, when brown and livid spots appeared, and after-

ward decay. "All the members of this genus, *Peronospora*," says M. C. Cooke, in his recent work on the fungi, "with which we are acquainted, are parasitic on living plants, inducing in them speedy decay, of which they are themselves the cause."

In treating of the remedies for the fungi we recommend:

1. To keep the plant as vigorous and healthy as possible by the means previously suggested; since we have seen that the fungi are much more likely to attack plants when in a morbid condition than when their vitality is active. This is generally the case with the potato, but perhaps not always, as the foregoing experiment tends to prove.

2. To consult the nature of the plant, and cultivate it in elevated and airy localities, where the superfluous moisture, which is so favorable to the growth of the fungi, may be quickly evaporated, and chills be avoided. "Choose positions," says C. E. Goodrich, "on high hills and mountains. On elevated positions is the last place to look for the potato disease. Here you will get heat enough in our warm climate, and avoid the burning temperature of the plains. You will probably suffer lighter chills after rain, and cold heavy dews, than in deep valleys. Here, too, you will most probably find that moisture of soil which will insure an even and steady growth." It has long been observed that potatoes cultivated in valleys or on low lands, in the vicinity of lakes and oceans, are much more liable to rot than on more elevated lands further back in the interior of the country, where there is less moisture from fog and other causes.

3. To avoid using such manures as contain large quantities of nitrogen; for, as nitrogen forms a large part of all fungi, such manures are very favorable to their growth. An evidence of the peculiar adaptation of these animal manures to the growth of fungi may be seen in the common mushroom, (*Agaricus campestris*,) which springs up in so great abundance, in a few hours, on manure heaps in warm, damp weather. In its composition it is similar to the *Peronospora infestans*.

4. To use such manures as are known to be destructive to the fungi and favorable to the growth of the potato. Wood ashes, lime, gypsum, sulphur, and salt—the latter in small quantities—are unfavorable to the growth of fungi, and favorable to that of the potato. It is well known that the alkalies, applied directly to the growing fungi, immediately destroy them. When mixed in the soil, or applied to the potato in the hill, they are absorbed by the roots, and carried by the sap into the stems and leaves, and thus, being brought into contact with the seeds or the tender fungi, destroy them. In numerous cases alternate rows, manured with barn-yard manures and with alkaline substances respectively, have produced diseased or healthy potatoes, according as one or the other manure was used.

From this it may also be seen why potatoes grown on burnt lands are always sound, mealy, and free from rot. A case is at hand of a farmer who scattered ashes on all his wheat-field at the time of sowing, except a small part which he was obliged to omit. The consequence was that the wheat, grown on the part to which the ashes were not applied, was almost entirely destroyed by mildew, (*Puccinia graminis*,) while the remainder was untouched. These manures may be applied to the whole field broadcast, alone, or formed into compost by mixing with muck, leaves, &c., for the general dressing when needed, and also applied directly to the potatoes in the hill.

5. To burn the tops infected with the disease at the time of digging the potatoes, in order to destroy as many of the seeds of the fungi as possible, as a preventive to their growth the next year. It is not sup-

posed that a great number would be destroyed by this process, in comparison with the millions which matured and dispersed themselves so widely; yet it might have a tendency to check, in some degree, their rapid multiplication and dispersion in future.

KIND AND PREPARATION OF SEED.

It has been shown, in the foregoing remarks, that potatoes used for seed should be from medium size to larger, and planted whole. It is desirable to have some above the medium size, to prevent deterioration to tubers too small, since there is always a tendency to fall below the parent stock rather than to rise above it.

The question now presents itself, whether it is desirable to cut potatoes not to be grown for seed. Dr. H. F. Hexamer, of New York, gave, before the New York State Agricultural Society, the result of seventeen different ways of planting the potato. He obtained the best result from planting one large whole potato in a hill; the next best yield was from two large half-potatoes, cut lengthwise; the next from the seed end* of a large potato; the next from a large half-potato cut lengthwise; and nearly the same result when the large potato had its seed end cut off. The smallest yield was from half a small potato; one piece with an eye did a little better. He finds the greater the yield the larger the amount of large potatoes in proportion to small. He used no small potatoes for seed. A medium-sized potato he plants whole; cuts large ones in two pieces; and the largest in four pieces, always taking care to select sound and well-developed potatoes.

From this experiment it would seem that the largest crop can be raised from whole potatoes, and the smallest from small ones.

J. T. Warder, of Ohio, says: "I have just completed my second experiment with assorted seed potatoes. They were the Harrison. The rows were three feet apart, twenty-two and a quarter rods long, and very even in quality of soil. No. 1 was planted with whole potatoes as near the size of hulled walnuts as I could get them; was drilled with fourteen pounds of seed, equal to $9\frac{1}{5}$ bushels per acre; and produced $5\frac{1}{2}$ bushels, equal to $217\frac{1}{2}$ bushels per acre. No. 2 was planted with cut seed, two or three eyes to each set, from selected, fair-sized potatoes, drilled in the same way as No. 1, with twenty-one pounds of seed, $13\frac{1}{2}$ bushels per acre, and produced $6\frac{21}{60}$ bushels, equal to $254\frac{1}{5}$ bushels per acre. No. 3 was planted with large-sized, selected potatoes, drilled, but further apart than Nos. 1 and 2, with forty-eight pounds of seed, equal to $31\frac{1}{8}$ bushels of seed per acre: and produced $6\frac{2}{3}$ bushels, equal to $263\frac{1}{3}$ bushels per acre. No. 4 was planted with halves of the same selection as No. 3, with twenty-seven pounds of seed, equal to $17\frac{4}{5}$ bushels of seed per acre, and produced $6\frac{1}{2}$ bushels, equal to $257\frac{1}{12}$ bushels per acre. It was planted the same distance as No. 3, and contained the largest proportion of salable potatoes, with No. 2 next, and with almost equal proportions of large ones as in Nos. 1 and 3. This experiment, in connection with one made last year, would induce me to cut good, salable-sized potatoes for seed, in preference to using them whole; and, in times of scarcity, to use small potatoes, with care not to plant them too closely together."

In this experiment the smallest potatoes yielded the largest crop in proportion to the weight of seed, the cut next, and the whole ones least of all. But the small ones were objectionable, because they yielded too large a proportion of small potatoes.

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* The end opposite the stem which connects the potato with the stalk.

George Maw, of England, in speaking of his experiment, says: "1. Every increase in the size of the set, from one ounce to eight, produces an increase of the crop much greater than the additional weight of the sets planted. 2. The net gain over the extra weight of the sets in planting four-ounce sets in lieu of one-ounce sets amounted, on the whole series of experiments, to from three to four tons per acre, or over one hundred bushels. 3. The additional gain on the increase of size of the set from four ounces to eight averaged about *five* tons per acre, or over one hundred and sixty bushels. 4. Increasing the intervals at which the sets were planted in the drills, even those of the largest size, to more than twelve inches, diminishes the crop per acre. 5. Weight for weight, cut sets produce, as nearly as possible, the same weight per acre as whole potatoes."

From an examination of the results of this experiment, there would seem to be little or no difference, so far as the crop is concerned, whether potatoes are planted whole or cut. Again, nothing is lost by close planting within a certain limit; for the excess of the crop much more than balances the weight of extra seed used.

Professor W. W. Daniells, of the Agricultural College of Wisconsin, in an experiment made with the Peach-blow potato, divided the ground, (thirty-five rods in length, and nine in breadth,) lengthwise, into eight parallel sub-divisions of five rows each, and planted in rows, three and a half feet apart each way, and three inches deep, with seed prepared as follows:

Sub-divisions.	Method of preparing seed.	Bushels of seed per acre.
No. 1 ..	Seed whole, and of large size, one potato in a hill	20
No. 2 ..	Seed of large size, cut into four pieces, three pieces in a hill, four inches apart	15
No. 3 ..	One small potato in a hill	8
No. 4 ..	Small potatoes cut into thirds, three pieces in a hill, four inches apart	8
No. 5 ..	One seed end of medium-sized potato in a hill	
No. 6 ..	Half a medium-sized potato, without seed end, in a hill	5½
No. 7 ..	The same as No. 2	15
No. 8 ..	Single eyes, three in a hill	

At the time of digging, five small plats, of fifty hills each, were taken from each sub-division in various parts of it, the potatoes weighed, and the mean taken as the average yield for that sub-division, giving the following results:

Sub-divisions.	Yield in pounds on five plats in each subdivision.					Total on five plats in each sub-division.	Size.	Bushels per acre.
	Plat 1.	Plat 2.	Plat 3.	Plat 4.	Plat 5.			
No. 1 ..	115	96½	125½	102	80½	519½	Large	123
No. 2 ..	110½	84	99	74	92	46[illegible]½	Large	110
No. 3 ..	108½	99½	92½	86	92	478½	Large	113
No. 4 ..	100	100½	95½	96	86	478	Medium	113
No. 5 ..	87	91	93½	98	84	453½	Large	107
No. 6 ..	118½	123½	119	104	94	559	Large	132
No. 7 ..	124	97½	100	94	93	508½	Medium	120
No. 8 ..	109½	56	66½	57	66	355	Small	84

From a review of the preceding table, it will be seen that no two of the small plats produce the same quantity of potatoes, although the soil, planting, and culture were the same, as nearly as they could be

made so. Therefore, no experiment on a single plat could be conclusive to establish a general principle. It will also be observed that the cut tubers, with the exception of No. 4, produced more from the same weight of seed than those planted whole; but Professor Daniells says that the large whole potatoes in No. 1 produced the most vigorous plants, and those in No. 8, with single eyes, the least vigorous.

If a greater crop can be grown on a given area from the same weight of seed when cut than when whole, as the last experiment and that of Mr. Warder seem to prove, because the pieces can be made to occupy more places in consequence of being more numerous, it would be desirable, for economy in seed, or when the quantity is limited, to cut those grown for the market; but they should be divided into pieces of sufficient size to produce strong plants, and allowed to dry a week or two before planting, to harden the surface. If, however, the soil is very rich, they may be cut into smaller pieces than when it is less fertile. It is also recommended to moisten them, whether cut or whole, and sprinkle with pulverized lime or ashes, to form a coating on the surface. Whole potatoes should always be planted for an early crop, since they will commence growing several days sooner than when cut; and a part of the field having the most suitable location and soil should be reserved, and planted with whole potatoes for seed.

KINDS AND PREPARATION OF SOIL.

The best soil, probably, aside from burnt land, for growing sound, mealy, and healthy potatoes, and which is accessible to agriculturists in general, is a light, loamy, green-sward pasture land, moist but not wet, and sufficiently fertile to produce one hundred to one hundred and fifty bushels per acre, with the common alkaline fertilizers applied to the hills. It is very important to select a soil congenial to the growth and perfection of the potato; for, unless this is done, good potatoes cannot be grown even from the best varieties. It should be plowed in autumn as deeply as possible, and sufficiently early for the sod to decay by the next spring. Early in the season, as soon as the ground is dry enough to work, it should be cross-plowed, and carefully harrowed, so as to mellow the soil, and pulverize it thoroughly. If the land is not sufficiently fertile, it will be safe to manure it carefully with a compost of lime, ashes, and muck spread evenly on its surface before cross-plowing. If a great crop is desired, and there is no fear of rot, the land may be heavily dressed with barn-yard manure, and a crop of corn, which will bear stimulating fertilizers, taken from it the first year, and potatoes the next. The barn-yard manure would become so much decomposed during the year, that no very serious injury need be apprehended, provided ashes or gypsum are used in the hills. Old land, or that which has been previously cultivated in some other crop than potatoes, should be plowed deeply and thoroughly pulverized.

PLANTING AND HOEING.

Drills may be made for the potatoes, by plowing at intervals of three feet from center to center, running north and south, if practicable, that the sun may dry off, as quickly as possible, any superfluous moisture that may happen to accumulate. If planted in hills, two and a half feet between the sets in the rows would be a proper distance; if in drills, from twelve to fourteen inches. If a great crop is desired, without regard to convenience in cultivation, or liability to rot, they may be planted twenty-seven inches between the rows, and ten inches in the drills. More potatoes

can be raised from the same area of ground by planting in drills than in hills, and this method is preferable in common cultivation, unless the land is very rocky, or infested with troublesome weeds. But when the potato is cultivated on a very large scale, and principally or wholly by machinery, the quantity of land used being of no consequence, some prefer to make the hills three and a half feet apart each way, in rows running in two directions at right angles to one another, thus securing the important advantage of cross cultivation.

After the potatoes have been dropped, a small quantity of ashes, pulverized lime, or gypsum should be thrown around them to promote their growth and prevent the rot. It is also an admirable plan, at the first hoeing, to put ashes, lime, or gypsum, in small quantities, on the hills.

If the land is plowed to a proper depth, and thoroughly drained, the potatoes should be covered about four inches deep; if not in such condition, half that depth would be sufficient, and additional soil should be drawn around them when hoed. They are sometimes very expeditiously covered with a plow, so managed as to turn back upon them the furrow made by drilling, and also with the mold-board or the shovel cultivator, by running it astride the drill. A potato planter, lately invented, which drills the ground, cuts, drops, and covers the potatoes, all at the same time, is used with great satisfaction in some parts of the country.

It is the opinion of some of our best agriculturists that very little or no hilling is necessary when the land is properly prepared. High, conical hills shed the rain, and let in much heat during the hot season of summer, which hinders the growth of the plant. Potatoes should be kept free from weeds at all seasons, but hoeing after the tubers have begun to set should be performed with extreme care, that they may not be disturbed or otherwise injured.

HARVESTING AND STORING.

Little need be said in respect to harvesting. The inquiry is frequently made whether it is best to dig potatoes as soon as they are ripe, or to allow them to remain in the ground till later in the season. In warm climates it would probably be best to dig them as soon as they are ripe, and remove them to a cool place. In northern latitudes, where they would be sufficiently cool in the ground, it would be much better to allow them to remain till the close of the season, being careful always to dig them before the beginning of the fall rains, while the ground is dry and the weather pleasant. It will be of no advantage to dig them early to avoid the progress of the rot; as, if they are affected, the disease will go on, and digging and storing early will only add the unpleasant labor of removing them from the bin, and picking out the diseased tubers. The potato hook, which is a kind of hoe with four to six strong steel prongs, is a more convenient implement for digging than the common hoe; and, where the land is free from stones and other obstructions, the potato digger, in some of its recently improved forms, which leaves the potatoes behind it on the surface of the ground, or picks them up in a box, as may be preferred, is employed by many farmers with success, and found to be a great labor-saving machine.

After being dug, potatoes should always be allowed to remain on the ground till they are thoroughly dry, which will be effected in a few hours if the weather is warm and pleasant. If not, they must be removed to the barn, or some other convenient place, and dried as soon as the weather will permit, and afterward stored in the cellar, in a cool place.

It will be found convenient to assort them when picked up from the ground in the field, those intended for family use and the market being

placed in a bin by themselves, and the small and imperfect ones kept for feeding to animals. They are sometimes assorted by using a wire-riddle, which allows the small ones to pass through it, while the large ones are retained. Those which have been planted especially for seed require particular care in assorting, which can be exercised only by an experienced person, who should be able to select those most suitable in size, the most symmetrical and perfect in form, well matured and solid. It cannot be determined with certainty whether a potato is solid throughout, yet an expert can generally come to a very correct conclusion.

In storing, each class should have its appropriate bin, easily accessible without interfering with the others. The place should be moderately cool, and not liable to sudden and great changes of temperature. Hence, the cellar should be so constructed as never to make it necessary to resort, in the coldest weather, to the artificial heat of a stove or other apparatus. The potato will endure a great deal of cold without injury, but a small excess of heat soon destroys it. It will bear a temperature of two degrees below the freezing point for several days; but, if exposed below this, it soon freezes, and becomes unfit for food or seed. It is very unsafe to expose it below the freezing point; and, if possible, the cellar should be arranged in such a way that the lowest temperature may not exceed thirty-five degrees, nor the highest forty-five; otherwise, germination may commence, which would have a very injurious effect upon the potato.

RECENT EXPERIMENTS.

Dr. H. F. Hexamer, of New York, in a series of experiments, attained the following results: 1. Of seventy hills of potatoes, pared so that no eyes were visible, thirty-five grew; some produced very large potatoes, and most of the tubers planted remained hard and firm till time of digging. 2. Of eighty hills planted with pieces cut without eyes, thirteen hills grew; all of which sprouted on the cut surface, none through the skin. 3. Of one hundred whole potatoes planted, ninety-eight grew from the small end, and one from the side. Of more than one-half the potatoes planted whole, only one eye grew from each, the rest remaining dormant.

Dr. Hexamer gives the following list of varieties of the potato cultivated by him, the length of time each had been planted on the farm, the marketable product of each per acre, and its hardiness:

Variety.	Years planted.	Bushels per acre.	Hardiness.
Cuzco	Third year	369	No rot.
Monitor	First year	262	Rotted badly.
Pinkeye Rustycoat	Third year	249	No rot.
White Peach Blow	Third year	235	Rot.
Fluke	Third year	215	No rot.
Peach Blow	Third year	200	Much rot.
Mercer	Third year	189	Much rot.
Bulkley's Seedling	Third year	188	Much rot.
Garnet Chili	Third year	166	Rot.
Buckeye	Third year	150	Eaten by grubs.
Early Goodrich	Third year	145	No rot.
Prairie Seedling	Third year	125	Rotted badly.
Colebrook	First year	109	Rot.
Early Cottage	Third year	113	No rot.
Blue Mercer	Third year	105	Rotted.
Gleason	First year	95	No rot; poor location.
Jackson White	First year	90	Rot.
Dykeman	Third year	85	Little rot.
Prince Albert	Third year	80	Rotted badly.
White Rock	Third year	75	No rot.
Rough and Ready	Third year	62	Rotted.
Early Sovereign	Second year	57	No rot.
Early June	Third year	53	No rot; poor location.

A correspondent of the Working Farmer planted three rows of Davis Seedling potatoes side by side, and manured them in the hill alike: 1st, small whole potatoes; 2d. large cut potatoes; 3d. whole potatoes of medium size. The cut potatoes were of large size, and an entire potato, cut into equal parts, was put in each hill. They all produced potatoes of good size, but the row planted with cut tubers yielded about one-fifth more in quantity, and of rather larger size than either of the others.

At Old Westbury, New York, nine varieties of the potato were planted on soil prepared alike, and produced as follows: The Calico, 267 bushels; Harrison, 265; Gleason, 254; Early Rose, 235; Vanderveer, 227; Gardner, 215; Peach Blow, 197; Early Goodrich, 188; Early Samaritan, 96. The Early Goodrich and Early Samaritan were badly eaten by the potato bug, which accounts for their small yield. The Peach Blow and the Calico are declared to be of very good quality; the Early Rose, Early Goodrich, Early Samaritan, good; the Gleason, Vanderveer, and Gardner, medium. The Harrison is thought to be the best winter variety, and ripens two weeks earlier than the Peach Blow. The Early Rose is regarded as the best early variety, ripening two weeks before the Early Goodrich.

S. S. C. Moreland, of Pennsylvania, planted some large potatoes of the Cuzco variety, with the following results: Ten hills with one potato each, ten with two halves each, ten with one half each, ten with four quarters each, ten with two quarters each, ten with one quarter each. The hills were three and a half feet apart, and manured alike. When they were dug, the difference was so trifling as not to be worth naming. The hills with two quarter pieces, however, did rather the best. By the side of these was planted a small piece with the same variety, in the old way, one foot apart, and the yield was more than twice as great as that from the others planted in hills.

A Pennsylvania correspondent of the Farm and Fireside planted seven hundred and eighty hills of potatoes, as follows: In the first row three pieces in a hill; in the second row, four pieces; and so on through the field, the rows alternating with three and four pieces, respectively, in a hill. Each row was dug separately, and the product weighed. The result was, that three hundred and ninety hills with three pieces yielded 1,401 pounds; and the three hundred and ninety hills with four pieces yielded 1,570 pounds—a gain of one hundred and sixty-nine pounds, when four pieces were put in a hill. He also planted in a pile of mud, of uniform fertility, thirty-six hills with four pieces in a hill, which yielded 125¼ pounds; and thirty-six hills with five pieces in a hill, with a product of 136¾ pounds; a difference of eleven pounds in favor of the hills containing five pieces. From these experiments an argument is derived in favor of heavy seeding; but if there is too much seed the potatoes will be smaller.

A correspondent of the American Agriculturist planted five pounds of whole potatoes twelve inches apart, with a yield of eighteen pounds; in the next row, five pounds of halves six inches apart, with a yield of twenty pounds; while one and three-quarters pound of single-eye pieces produced ten pounds. There was no discoverable difference in the quality of the potatoes, and very little in size. Those of the whole tubers were a trifle the largest. This makes it appear that, in the proportion of crop to seed, the advantage is largely in favor of single eyes; for in the same proportion the whole and the half potatoes should each have yielded 28.57 pounds, instead of eighteen pounds and twenty pounds, respectively. Having reference to the ground occupied, the result is in favor of the halves first, and the whole potatoes second. The halves yielded double,

and the whole ones nearly double the yield of the single eyes on the same surface of ground. Although the quantity of seed and the ground planted with whole and with half potatoes were the same, the distance apart was double in the first mentioned.

J. N. Stearns, of Michigan, planted one pound of the Early Rose potato, comprising two large potatoes and a small one. He cut the two larger tubers through the middle, taking one-half of each for the experiment. On cutting the eyes he had sixteen in each potato. He cut through each eye of one of the potatoes, making thirty-two pieces, and put one-half an eye or one piece in each hill; and the sixteen eyes of the other potato were planted with one eye in a hill. From the thirty-two pieces, cut by dividing the sixteen eyes, he had 45¾ pounds; from the sixteen pieces planted with an eye in each, 19¼ pounds; from the small potato planted with a single eye in each piece, he had 17¾ pounds—making in all 82¾ pounds, or nearly one and a half bushel from one pound of potatoes.

W. H. Crane, of Minnesota, planted four pounds each of the Early Goodrich, the Harrison, the Gleason, and the Cuzco potato, cutting them into pieces with a single eye, and planting in drills three and a half feet apart, putting one piece at every eighteen inches in the drill, with the following results: From the Early Goodrich he harvested 16½ bushels; the Harrison, 22¼ bushels; the Gleason, 9¾ bushels; the Cuzco, 27½ bushels; making 76 bushels from sixteen pounds of seed. From nineteen eyes of the Harrison he raised two bushels of potatoes, producing at the rate of eight hundred and ninety-three bushels to the acre.

William Goodrich, jr., of New York, planted in drills three feet apart, and sets nine inches apart in the drills, one barrel each of the Cuzco, the Orono, and the Harrison potato, cut into pieces containing two eyes. Each variety yielded about twenty barrels, being at the rate of about one hundred barrels to an acre. The Cuzco yielded a few less than the Orono, and the Harrison a few more. The Orono was a little the earliest, the smoothest, and best table potato, and also the best market variety. Mr. Goodrich thinks he should have had more potatoes from the same seed had they been planted fifteen inches in the drill instead of nine inches, but not so many per acre. They were all free from disease.

A correspondent of the Cultivator and County Gentleman states that his Harrison potatoes turned out two hundred bushels to an acre; Gleasons, three hundred bushels; and that his Cuzcos outstripped all others. He estimated the yield at five hundred bushels per acre.

Joseph L. Orr, of Massachusetts, raised from four pounds of the Early Goodrich potato three hundred and seventy pounds, or over ninety-two pounds from one pound. The ground on which they grew contained 1,035 feet, including a margin of eighteen inches. They were planted the 25th of May; stocks blighted the middle of August; dug the middle of October.

John Danforth, of Connecticut, planted twenty pieces of the Early Goodrich potato in his garden, making twenty hills, manuring them with hog manure. The product, dug on the 17th of August, was three bushels and one peck of the finest potatoes he ever saw, weighing ninety pounds.

E. A. Fassett, of Pennsylvania, planted sixteen potatoes of the Early Rose variety, weighing three pounds in all. They were cut in pieces containing a single eye, and planted with one piece in a hill, three feet apart each way. They made about two hundred hills, from which were dug fourteen and a half bushels, or at the rate of two hundred and

ninety pounds from one pound. Four of the best hills filled a half bushel, and the largest potato weighed two and three-quarters pounds. As to quality, from the limited trial made, he thinks that they are nearly or quite first-rate when mature, but poor and watery when young, and growing rapidly.

Thomas M. Harvey, superintendent of the East Pennsylvania Experimental Farm, reports the following results of a series of experiments:

No. 1.—The varieties of the potato planted were of different sizes, cut so as to make the number of pieces in a row, as given in the table. Phosphate, 800 pounds to an acre, applied in the rows.

Varieties.	No. of pieces planted in each row, 15 lbs. to a row.	Salable potatoes per row of 100 yards, by weight.	Culls per row of 100 yards, 1¼ inch or less in diameter.
Planted the 12th of May.		*Pounds.*	*Pounds.*
Orono	220	167	5¼
Jackson White	228	123½	7
Carter	214	166	7
Early Sebec	213	86½	6¼
Cuzco	225	165¼	10
New York Seedling Mercer	217	86½	8¾
Gleason	214	137½	5¼
Andes	224	129½	3¾
Michigan White Sprouts	221	66	9½
Prince Albert	225	104½	11
English Fluke	210	24½	21
Buckeye	216	82	5¼
Ohio Peach-blow	218	88	8½
Michigan Peach-blow	229	93	6
Planted 25th of May.			
Garnet Chili	208	147¾	3
California Mercer	213	76½	13
White Mercer Seedling	205	80¼	6½
Calico	208	202¼	5
Jersey Monitor	205	125¼	3
Shaker's Fancy	212	121¼	2
Buckeye	225	85	5¼
Hinnman		104½	3¾
Vanderveer's Seedling	216	140½	9¼
Nutmegs	210	79½	11¼
White Peach-blow	214	76½	8

No. 2.—Bone phosphate, 1,000 pounds spread on the first acre; planted the 5th of May, in rows three feet apart, one potato or piece in a hill.

Variety and form of seed.	No. potatoes to make 60 pounds seed planted.	No. potatoes or parts planted per row.	Salable potatoes per row of 100 yards.	Culls per row of 100 yds, 1¼ in. or less in diameter.
MERCERS.			*Pounds.*	*Pounds.*
Whole tubers, large	275	114	93¾	8
Cut, quartered lengthwise	553	200	50	5¼
Cut, halved lengthwise, then across, stem end	387	258	72	4
Same seed cut as preceding, only seed end	387	226	56½	6
Whole tubers, medium	609	170	101	7
Cut, halved	610	224	69½	6
Whole tubers, small	1,295	259	71½	10¼

Bone phosphate, &c.—Continued.

Variety, and form of seed.	No. potatoes to make 60 pounds seed planted.	No. potatoes or parts planted per row.	Salable potatoes per row of 100 yards.	Culls per row of 100 y'ds, 1¼ in. or less in diameter.
MONITORS.				
			Pounds.	*Pounds.*
Whole tubers, large	158	100	150	3½
Quartered lengthwise, large	158	210	135	4
Halved and crossed, large, seed end this row	158	216	129¼	3½
Halved and crossed, large, stem end in this row	158	225	134¼	5
Whole tubers, medium	375	152	135¼	6½
Halved tubers, medium	375	246	127½	8
HARRISON.				
Whole tubers, large	220	102	146¾	8¾
Cut, quartered lengthwise, large	220	221	122	13
Halved, then crossed, large, seed end in this row	220	207	127½	11
Same cut, large, stem end in this row	220	230	156	10½
Whole tubers, medium size	412	162	185	13½
Cut, halved lengthwise, medium size	412	212	187	14
Small whole tubers	8[illegible]0	240	184	12
EARLY GOODRICH. (Planted the 9th of May.)				
Whole tubers, large	261	105	71	9
Cut, quartered lengthwise, large	261	233	78	9½
Cut, halved, then cut across, large, seed end in this row	261	234	66¼	8¾
Cut same as preceding, stem end in this row	261	223	62¼	7¼
Whole tubers, medium	461	156	93¼	14¼
Cut, halved lengthwise, medium	461	....	74	8

No. 3.—Stable manure, fourteen loads spread on the second acre; same kind and form of seed as on the preceding phosphate; planted 11th of May, in rows three feet apart, one potato or piece in a hill.

Variety, and form of seed.	No. of potatoes to make 60 pounds seed planted.	No. of potatoes or parts planted per row.	Salable potatoes per row of 100 yards, by weight.	Culls per row of 100 yards each, 1¼ inch or less in diameter.
MERCERS.				
			Pounds.	*Pounds.*
Whole tubers, large	324	100	112¾	6
Cut, quartered lengthwise, large	324	197	67¾	4
Cut, halved, then cut across, seed end in this row	324	203	109¾	5
Cut same as preceding, stem end in this row	324	224	125½	5½
Whole tubers, medium	562	160	141	8¼
Cut, halved lengthwise, medium	562	210	110¼	9¼
Whole tubers, small	1,200	216	108	11
MONITORS.				
Whole tubers, large	176	103	230	3¾
Cut, quartered lengthwise, large	176	223	210	4¼
Cut, halved, then cut across, seed end in this row	176	213	206¼	4¼
Cut same as preceding, stem end in this row	176	216	204	6¼
Whole tubers, medium	358	156	245	5
Cut, halved lengthwise, medium	358	220	220	5
HARRISON.				
Whole tubers, large	221	113	266¾	13½
Cut, quartered lengthwise, large	221	211	234¼	14½
Cut, halved, then cut across, seed end in this row	221	220	232¼	17½
Cut, halved, then across, stem end in this row	221	194	192¼	15¾

Stable manure, &c.—Continued.

Variety, and form of seed.	No. of potatoes to make 60 pounds seed planted.	No. of potatoes or parts planted per row.	Salable potatoes per row of 100 yards, by weight.	Culls per row of 100 yards each, 1½ inch or less in diameter.
HARRISON—continued.			Pounds.	Pounds.
Whole tubers, medium	474	151	203	16
Cut, halved, medium	474	228	292	22
Whole tubers, small	889	237	306½	16½
EARLY GOODRICH.				
Whole tubers, large	265	106	114½	9¼
Cut, quartered lengthwise, large	265	221	115	6¾
Cut, halved, then cut across, seed end in this row	....	220	111	5¾
Cut same as preceding, stem end in this row	....	225	113½	6½
Whole tubers, medium	461	157	120	14
Cut, halved lengthwise	461	224	117	12¼
Whole tubers, small	....	214	153	17

Jonathan Talcott, of New York, planted Jackson White, the Early Goodrich, and the Ohio Russet, of which the Jackson White was eight or ten days the earliest, and also the best in quality; yield about a hundred and fifty bushels per acre. The Early Goodrich, though a few days later, is preferred for its hardiness, smooth and perfect appearance, and yield per acre. The Ohio Russet matures with the Early Goodrich, is full as good in quality, but the yield is only medium.

A correspondent of the Rural American has for several years raised the Garnet potato, and says he finds it all its originator ever claimed for it. The Gleason he thinks far ahead of any variety he has ever raised, in respect to yield and freedom from rot; although, as a table potato, he considers it no better than the Garnet. From eight pounds of this variety he raised one barrel of fine potatoes, without extra cultivation. He planted eight rows of the Gleason, four of the Garnet, two of the Peach-blow, and five of the Eastern Red, putting a forkfull of coarse manure in each hill, by way of experiment. He generally applies a large handful of ashes instead of barn-yard manure. From the eight rows of the Gleason, thirty-three bushels were harvested, nearly all fit for the table, and entirely free from rot; from the eleven remaining rows of the varieties named, only thirty bushels were gathered, making a yield of one and three-tenths bushel in favor of the Gleason. Only a few diseased potatoes were found among the Garnets, but many among the Peach-blows and Eastern Reds.

Andrew Archer, of Maine, planted side by side, and on the same quality of land, seven varieties of the potato, with the following results: The Cuzco yielded 370 bushels per acre; the Orono, 320; the Early Goodrich, 320; the General Grant, 304; the Early Sebec, 264; the Mercer, 240; the Jackson, 240. He states that the Early Goodrich, the past year, maintained its former reputation as a first class potato in every respect; and that the General Grant is equally so, either for the table or the market, and is the earliest variety on record, cultivated in Maine, being two weeks earlier than the Early Sebec, and three weeks earlier than the Early Goodrich. The Early Goodrich and the General Grant do not rot, and he thinks they are far superior to any other varieties now grown in that State.

Isaac Hicks and Sons, of New York, planted nine rows of each of nine

varieties, with the following results: The Early Goodrich yielded 188 bushels per acre: Early Samaritan, 96; Early Rose, 235; Harrison, 265; Calico, 267; Gleason, 254; Vanderveer, 227; Gardner, 215; Peach-blow, 196. All were dug before the middle of September. The Peach-blows were beginning to rot, and were sent to the New York market as fast as possible. Three or four only of the Gleasons were found rotten in each barrel; all the other varieties were sound, and kept well. The Peach-blow brought, in the market, \$3 75 to \$4 per barrel; the Gleason, \$2 50 to \$3; the Vanderveer, \$2 50; and the Early Goodrich, \$2 25.

Mr. Bristoe, of Kentucky, planted the varieties named below, with the results annexed:

Varieties.	Seed planted.	Yield.
	Pounds.	*Pounds.*
White Sprout	10½	231
Early Goodrich	10½	299
Harrison	10½	283
Cuzco	10½	298
Shaker Russet	10½	265
Garnet Chili	10½	197
Buckeye	10½	227
Early June	10½	152
Peach-blow	10½	194
Jenny Lind	7¼	76

Mr. Bristoe does not regard the Peach-blow as a sure crop in the South; as, whatever the time of planting, it will not produce potatoes till late in June. He has planted from April to the middle of July, with about equal success.

The following table shows the results of an experiment made by Thomas Meehan, editor of the Philadelphia Weekly Press, and a committee of agricultural editors and others, by boiling fifteen popular varieties of the potato. The numbers affixed denote their qualities respectively. No. 1 signifies best; No. 2 next best, &c.:

Varieties.	Color.	Texture.	Flavor.	Total.
Early Goodrich	2	2	1	5
White Sprout	2	3	3	8
Felterid Early	3	3	3	9
Jerusalem	2	3	2	7
Early Rose	3	1	1	5
Peach-blow	2	1	3	6
Garnet Chili	2	2	2	6
Prince Albert	3	3	3	9
Gleason	2	2	2	6
Carter	2	2	2	6
Calico	3	3	3	9
Harrison	3	3	3	9
Cuzco	3	2	1	6
Andes	3	2	2	7
Jackson White	2	3	2	7

From an inspection of the table it will be seen that the Early Rose and the Early Goodrich hold the first place in the total value of their good qualities; but, as color is of less importance than either texture or flavor, the Early Rose must be regarded as the best on the list. The Cuzco, Garnet, Chili, Gleason, and Carter also take a high rank.

Peter Henderson, of New Jersey, cut one potato weighing four ounces into two parts, in such a way that the largest possible number of eyes in each piece would be presented upward; then each part was placed on

the soil of one of the benches of his greenhouse, at a temperature of about seventy degrees, and kept entirely dry until the cut surface had healed over, and shoots began to start from the eyes. The shoots, when four or five inches in length, were cut off about one-fourth of an inch from the surface of the potato, and rooted by shading and watering in the usual way, and then put in two-inch pots, in rich soil, and started to grow. Other shoots were afterward thrown up from the potato in great numbers, and rooted as before. When the first shoots were seven or eight inches high, cuttings were taken from the tops of these also and rooted; so that by the 1st of June one hundred and fifty good shoots had been produced from this potato, each of which was equal to a set made directly from the tuber. These sets were planted out the first week in June, in land not well suited for the growth of the potato. The crop, when dug in September, weighed four hundred and fifty pounds, equal to seven and a half bushels, being an increase of sixteen hundred fold.

It may be questioned whether this process is of any practical value, or whether it will pay. It is not claimed that it would, when potatoes bring only the ordinary price; but, when they are sold at the price at that time of the Early Rose, $3 per pound, there is no doubt whatever of its practical utility.

OSAGE HEDGES.

The cost of fences is a great burden upon agriculture everywhere. In the prairie sections, where stone is never available, and timber rarely at hand, the expense is increased: and here the feasibility of obtaining serviceable live fences is naturally an important inquiry. Western farmers have long been seeking the best plant for this purpose. In the climate of Great Britain the hawthorn *(Cratægus oxyacantha)* has been successfully employed for centuries; but, in the climate of the Mississippi Valley, it is not sufficiently at home to answer the purpose; the atmosphere is too hot, dry, and variable. The honey locust, *(Gleditschia triacanthos,)* has been tried, as also the buckthorn, *(Rhamnus catharticus,)* the Cherokee rose, *(Rosa lævigata,)* and others; but the Osage orange thorn, *(Maclura aurantiaca,)* after years of experiment, in different parts of the country, appears to be a more promising material for hedges than any other upon which experiments have been made. It was called by the French *Bois d'arc;* by the Indians, bow-wood; and Osage orange by the present inhabitants of the West. In 1841 it was thus described by William Kenrick:

"A native of Arkansas, where it rises in beautiful proportion to the height of sixty feet, and has been pronounced one of the most beautiful of our native trees. The wood is, perhaps, the most durable in the world, and for ship-building is esteemed preferable to live oak. It is valuable for furniture, as it receives the finest polish, and yields a yellow dye. It is remarkably tough, strong, and elastic, and preferred by the Indians to all other woods for bows. It deserves a trial for hedges. I know of no wood so beautiful for this purpose."

A few facts in the history of its introduction and use in the West, as a hedge plant, are stated upon the authority of Hon. M. L. Dunlap, of Illinois. In 1842 a nurseryman of Peoria County, Illinois, Mr. Edson Harkness, after a trial during two seasons, in which it was killed to the roots by frost, came to the erroneous conclusion that it would not stand the climate. In 1844 Mr. Charles H. Larrabee, of Pontotoc County, Mississippi, sent a package of seed to the editor of the Prairie Farmer, suggesting its probable utility as a hedge plant, and its great value to Illinois especially. In 1845 Professor J. B. Turner, of Jacksonville, Illinois, stated that it had proved hardy for six years, and that he thought it would make a good hedge, if the plants would bear close planting.

It is claimed that a Mr. Choteau, of St. Louis, planted Osage seed as early as 1800. The elder Landreth propagated some plants in 1803, which are now two feet in diameter, and thirty to forty in height. Mr Hancock, of Fulton County, Illinois, set a hedge in 1844. It was not till 1846 that any considerable quantity of seed was sent North. Mr. William H. Mann, then a resident of Fannin County, Texas, living upon Bois d'Arc Creek, hearing that the seed was worth eighty dollars per bushel at Cincinnati and in the northwest, proceeded to wash out thirty bushels of seed, for which he refused twenty dollars per bushel before starting, only to meet the disappointment, on arrival at Peoria, of learning that there was no demand for it, the impression having gone abroad that it was a failure. After some effort and delay, it was distributed in small lots,

upon a year's credit, at twenty dollars per bushel. The late Cyrus Overman, of Fulton County, entered into a copartnership with Mr. Mann in planting a few bushels of the seed, and from this beginning the growing of Osage thorn plants has assumed its present proportions. In 1851 three to five hundred bushels of seed were brought into Illinois, and in 1855 the firm above named brought from Texas one thousand bushels. Prior to 1860 the price varied with the demand from five to thirty dollars per bushel. In 1867 the trade in seed was resumed with a speculative demand, by which the market became overstocked, and the price was reduced from fifty to five dollars. In 1868 the trade amounted to eighteen thousand bushels. The price, eight dollars at first, went up to fifty. During the winter of 1868-'69, twelve thousand bushels went north of Memphis, ten thousand of which have been sold for the spring planting. The price ranged from twelve to eighteen dollars. Texas and Arkansas received not less than one hundred thousand dollars for Osage seed in the autumn of 1868.

It is estimated that ten thousand bushels of seed will be planted in the northwest in 1869, producing 300,000,000 plants, at 30,000 to a bushel of seed, and making 60,000 miles of fence, allowing 5,000 plants to a mile—enough to supply 22,000 farms of a quarter-section, at 840 rods to a farm. One nurseryman has four hundred acres of quicks growing.

Mr. Dunlap thus figures the comparative cost of live and of dead fences:

First year:	
To prepare the hedge-row for a mile of hedge will cost in labor about five cents a rod, equal to	$16 00
5,000 plants	12 00
Setting	4 00
Cutting and hoeing	16 00
Total	48 00
Second year:	
Cultivating and hoeing	16 00
Resetting of plants	4 00
Third year:	
Cultivating and hoeing	12 00
Totals	80 00

Total cost for three years, twenty-five cents per rod.

The next two years it will cost nothing, and will then be ready for plashing, or it may stand a year or two longer. We may add ten cents a rod for plashing and trimming, where the hedge will need an annual shearing, at a cost of about two cents a rod. This is in case the hedge is to be kept within bounds; but in many cases, where it is also valuable for shelter and for timber, this extra expense is not incurred. Such a fence, when ten years old, will be worth its full cost to be cut down for vineyard stakes, or similar use.

The first ten years of a first-class hedge should not cost a farmer, including interest for three years while it is growing, over fifty cents a

Fig. 1. Fig. 2.

Double hedge set low. Set on ridge.

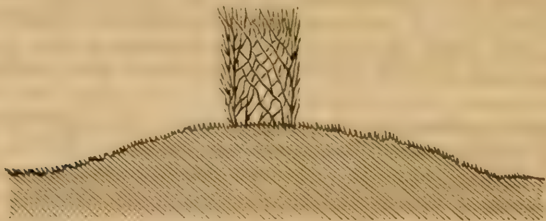
Fig. 5.

Vertical section of single row hedge.

Fig. 3.

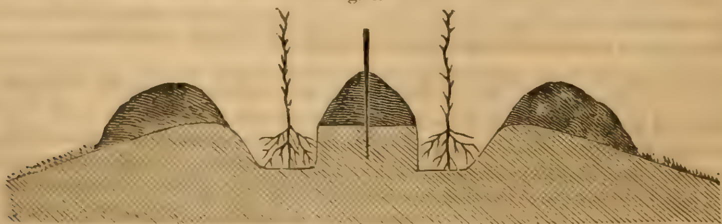
Oblique laying of double rows,

Fig. 4.



Vertical section of double hedge.

Fig. 6.



Cross section of double row trenches.

OSAGE HEDGE PLANTING.

rod, and the most of this in labor at odd times. This would make the hedging of the quarter-section farm cost, for twenty years, as follows:

840 rods hedging	$420
20 years' interest	840
20 years' shearing, two cents per rod	336
Total	1,596
Cost of board fencing	4,000
	2,404

The difference for the first twenty years is $120 per annum, and thus, instead of having $1,000 invested as original capital, we have but $420 in the hedge. It will require, at least, ten per cent. to keep the dead fence in repair, while $17 for each farm will keep the hedge nicely sheared. In one case we have a reliable hedge, and in the other an uncertain one of pine boards.

The following communication on the subject of Osage thorn hedges, received from Mr. J. W. Clarke, of Kingston, Greene Lake County, Wisconsin, is presented as the result of much thought and experiment, but not indorsed by the Department as infallible in all its positions:

THE OSAGE THORN.

Though this thorn has been variously and extensively experimented with, probably through half a century of time, with a view to its adaptability to forming a live fence, its successful propagation and growth on a large scale by nurserymen is a work of but recent achievement. The urgent necessity of some hedging material, as a substitute for board fence, has also been deeply felt only within a few years, or since railroads have made such fearful inroads upon the limited timber supply of the country. It is, however, a well established fact that the Osage thorn is quite as capable of being grown and trained, and of forming an effective live fence, in all but far northern States, as is the hawthorn in the British Islands. Its adaptation to the general purposes of hedging being a settled fact, the following notes and suggestions will be directed to the practical bearings of the principles of growing, plans of arrangement, and the most suitable methods of training or directing the growth of the Osage thorn, as a hedging plant.

NURSERYMEN PROPAGATE IT WITH SUCCESS.

Of this there can be no doubt, as it is thus grown in Illinois to the extent of hundreds of acres, and on an amply successful scale in various other localities. It must be stated, however, that the quicks are grown too thick in the nursery row, in many instances. Close crowding here is not favorable to the best growth of roots, which is as essential to Osage thorn quicks as to apple stocks, and as necessary to their best subsequent growth in the hedge row. The plants are more healthy when first grown on high, or at least on well-drained ground; the whole extent of their wood growth being firmer, and, if sometimes not quite so large or rank, better adapted to bear the vicissitudes to which young hedges are usually exposed.

PREPARING GROUND FOR SETTING OUT HEDGES.

Sod ground, designed for hedge sites, should be plowed six or seven inches deep, as early as the grass grows freely, in May, the year preceding the planting of the quicks. As soon as the sod is well rotted, drag and plow as many times as may be required thoroughly to pulverize the soil, and reduce it to such a condition of tilth as would be suitable for planting corn on old ground, the strip of ground so treated being at least six yards in width. This should be done either in September or early in October; not later, as the important and necessary operation of ridging up the ground, as a foundation for a successful hedge, is required to be performed before severe freezing weather. The safest course is to ridge before the 10th of November.

The necessity for ridging arises from the generally observed fact, that the natural drainage of the larger portion of the vast prairies is poor and ineffective, the soil in many localities being so overcharged with moisture, particularly in rainy seasons, as to materially check the growth of farm crops; and, as is well understood, the yield of corn and small grain is much reduced from this cause. The same is true of considerable districts of several of the better timbered States, where other fencing material is growing scarce.

The width of ground plowed should not be less than eighteen or twenty feet, as a narrow space may cause considerable inconvenience, where the adjoining land is sod or in grass. The height of the ridges should be as great as can be made by twice plowing, or gathering up the soil. In spongy or low, wet places, three gatherings with the plow will not raise the ridge too high. The soil having been well pulverized before ridging, may be harrowed once with a coarse harrow; but it need not be made smooth, as a harrowing just before plowing the furrow trenches, the succeeding spring, will be necessary to freshen and mellow the mold before other work is commenced. Among the advantages of ridging may be named the following:

First. The Osage quicks will be more likely to escape winter-killing, the exemption being due to the fact that the roots are above the level of saturation.

Second. Operations can be commenced and completed from ten days to two weeks earlier, in all localities where the natural drainage is inefficient, and Osage thorns can be set before the buds open.

Third. The roots of young quicks will strike down obliquely in ridged ground, instead of extending out horizontally just beneath the surface soil, and attain a growth corresponding with the increase of available soil.

Fourth. The young plants make a more uniform growth when ridged, in consequence of the more uniform condition of the soil as to moisture, and will generally be exempt from the gaps and thin places, resulting from partial winter-killing.

Fifth. When a ridge is properly prepared for thorn quicks, the roots of the hedge-row will form a more fibrous growth, which will be made chiefly in central parts of the ridge soil, instead of the roots growing long and straggling. If, in the course of years, however, straggling roots should be found to require pruning at a distance of eight or ten feet from the hedge-row, they will present less obstruction on a ridge than when grown upon level ground.

Sixth. When a hedge becomes strong enough to turn stock, it is desirable to check its growth, which can be done by cutting off the ends of the roots on the sides of the ridge with a pruning plow, or with a revolv-

ing colter, without endangering the life of the thorns, the large amount of root-growth in the deeper, central parts of the ridge being sufficient for the plant.

Seventh. A ridge eighteen to twenty-four inches above the level will add thirty to forty per cent. to the effective height of the hedge; and, in combination with the latter, will form a barrier that will turn stock, thus constituting an effective fence from one to two years sooner than when planted on low, level ground; and, at the same time, equally contributing toward the effectiveness of the hedge in its incidental capacity as a wind-break.

A plow colter, such as is used for cutting off the extremities of apple tree roots to induce early bearing, may serve a similar purpose in pruning hedge roots when extending beyond their prescribed limits.

Figure 1 represents a young, unlaid, double hedge-row, set in land relatively low. Figure 2, a similar hedge, set in a ridge two feet above the level of the adjoining land. These sketches afford an illustration of the difference, in extent and character of root growth, between young hedges set on the deep soil of ridges specially made for them, and those set on level ground, with their roots near a wet subsoil, as seen in Figure 1.

TRIMMING OR DWARFING.

As in the case of shortening back to induce the growth of fruit spurs in the apple tree, the effect of trimming Osage thorn hedge is to cause some thickening at the bottom, but the growth is chiefly in the upper part of the branches, or in the emission of numerous small side shoots, or lateral branches. Inexperienced writers recommend this mode of training to produce thick-bottomed, permanent growth. Thick side growth may, for a limited time, result from such management; as repeated cutting back leaves the plants, in their struggle for existence, the only alternative of the slow, feeble, lateral growth, to be seen in hedges that are not allowed to extend their growth vertically. Low-trained hedges may be necessary where land is limited in area, and high in price, as in case of gardens, small lawns, and other ornamental grounds; but in such situations plants of less vigorous growth than the Osage thorn would seem to be more suitable, for the reason that evergreen or shrubs may be formed, trimmed, and low-trained a long time without pleaching. With the vigorously growing Osage thorn, however, the case is different. Various plans of training were adopted, such as cutting off each row of two-rowed hedges alternately, also cutting out alternate thorns close to the ground, to induce a thick growth of young wood in the lower portions of the hedge; but the result of such training was not sufficiently satisfactory to secure its continuance. Hedges formed thus, principally of vertically growing stems, were found quite weak in comparison with pleached fences, the latter proving to be much more effective for the purpose of a farm fence.

Within a few years past an aggregate of scores of miles of young Osage thorns in hedge-rows has been more or less injured by winter-killing on the lower lands of the west; and cutting back to force lateral growth and thickening at the bottom of the plants was probably the inciting cause of much of this great destruction and consequent disappointment.

In many of these instances the hedge rows were not well rooted, the subsoil, and even the upper soil, being too wet and cold to admit of either ample or well-ripened root growth. Well-ripened wood is as necessary for

roots as for branches, to enable them to withstand either severe freezing or severe trimming. But the general reason for the loss of these winter-killed Osage plants was succulent, spongy, and tender wood in root and branch: and it must continue to be so with hedge rows set at the level of undrained soils. The plants seem too have died of too much cutting and too much water in the soil.

As already intimated, trimmed hedges surely grow thin in the lower parts in a few years, however well this operation may be performed. Great care and good management may postpone the "self-thinning," by the inside, shaded, and weak bottom branches dying out; but these branches will as certainly die out as that the sap tends naturally to the top parts of the hedge, where there is more heat and light. The north side of a hedge, being the most shaded, will be likely to fail first in the lower parts, when, from the necessity of thickening the bottom part, and renewing the live growth from the ground, the labor and cost of laying hedges that have long been subjected to trimming will be found greatly to exceed the cost of laying untrimmed fences.

The objections to untrimmed hedges consist mainly in their shading more ground than when trained low; but this is chiefly the case on the north side of east and west fences, crops getting as much sunlight in about half the time, on the sides of north and south fences.

HEDGES AS A HARBOR FOR INSECTIVOROUS BIRDS.

One of the greatest advantages of growing hedges is the fact that they provide shelter for birds. In a general sense, most insects are the enemies of improved vegetation; and they also comprise the natural food of most birds, and do vastly more damage where the country is open and birds are few.

It is a significant fact, that in a number of districts in England, where many of the hedges have been grubbed up, the increase of destructive insects has become so great that it has been found necessary to take measures for the preservation of the birds, particularly the hedge sparrow.

RENEWAL OF OSAGE THORN HEDGES.

It has been established by experience in the British Islands, and to a limited extent in this country, that hedges sooner or later become so thinned at the bottom that renewed or young bottom growths are essential to maintain their efficiency as fences; and this necessity cannot be evaded in the case of the Osage thorn. The sap tends so much towards the top that the lower part will become thin by "self-pruning," which will be succeeded by holes and gaps. This result may be expected in both trimmed and untrimmed hedges. These gaps and holes may be temporarily mended, however, by inserting detached branches cut from thicker parts of the fence. Layering has been suggested; but in the shade and in dry soil, in which the layer must grow, if at all, their growth will be so slow as not to become available against animals in any reasonable length of time, and it is probable that but few layers would survive.

Osage thorn hedges may grow to a height of twelve to twenty feet before they require laying. Laying reduces the height of the fence two-thirds or three-fourths, or more, causing the new growth to be made near the ground, and here, accordingly, multitudes of vigorous young saplings are sent up, growing up in like manner, at each successive laying.

THE STRENGTH OF TWO-ROW HEDGES WHEN PLEACHED.

Single-row hedges cannot well be renewed by laying without stakes. But double rows may not only be laid or pleached without stakes, but, when laid down in a proper manner, the hedges will constitute a very strong fence. Two-row hedges are believed to be much the best adapted to resist the stress of gales of wind, the attempts of rampant animals to break over them, and for any contingencies requiring great strength in a fence.

Figure 3 represents a section of the horizontal form of laying the brush of each of the rows backward and obliquely over to the opposite side. The stems of the thorns are pleached, one from each side or row, alternately, each sapling being brought down from the opposite side, and laid in such a manner that each stem crosses the last one laid, about midway of its length, and in the center between the hedge rows, the angle formed between the saplings and the ground being about thirty degrees. In illustration of the great strength of this form of two-rowed hedge, Figure 4 represents a vertical section of the same, which is five feet high above the ridge, and forms an almost impassable barrier against any farm stock.

SINGLE-ROW HEDGE NOT EFFICIENT UNLESS STAKED.

After special examination of one-row fence, in Illinois, both unlaid and such as is called laid, the conclusion is reached that neither neat nor efficient single-row hedge can be made without the aid of stakes; and it is stated that in the British Islands, stakes are always employed to give it stiffness, and hold it in line in pleaching. Specimens of the single-row Osage thorn that we saw had much the appearance of a line of brush with tops all outward, and butt-ends in the center. Such single-row fence spreads so wide, and settles to the ground so much, that it occupies even more space, as seen in Figure 5, while not possessing a third of the value, as a fence, that is required by a substantial two-row hedge; and the single-row fence—it cannot be correctly called hedge—must sag and settle toward the ground, if pleached without staking. We have examined some specimens in which there were live stakes, obtained by cutting off the tops, and leaving the lower of the thorn stems.

DISADVANTAGES OF LIVE STAKES.

Live stakes may save a portion of the time that should be devoted to preparing others, but the subsequent disadvantages resulting from their use will more than outweigh the trifling saving of time effected. A hedge becomes thin at the base of the growing stakes, the sap ascending and forming a spreading, stool-like form of growth, where the hedge is trimmed at the top of the stakes, instead of sending up shoots, as would be the case if the stake saplings were laid at the bottom to thicken it with young growth. Another defect is, that numbers of vigorous shoots spring from the crowns of the stakes, forming and maintaining a growth of shoots two or three feet in advance, and higher than the general height of the hedge. It is also necessary to cut live stakes off at the ground preparatory to relaying the hedges, which is not required when detached wood is used. Dead or detached stakes are always preferable to live ones; they serve two or three years before decaying, by which

time the form and material of the hedge become set, or firmly fixed by growth, and stakes are no longer necessary.

The tops of the stakes, set three feet apart, are bound at the top by winding or wattling long, slender, thorn stems so as to inclose the tops of stakes between them. The object of staking is to so stiffen a hedge that it can be made with far less thorn material than would be practicable if stakes were not employed. The stakes also prevent the sagging of pleached or obliquely laid saplings, preventing the oblique material from smothering the young undergrowth of shoots from the base of the fence. The strength imparted by the stakes also prevents the brush from being pushed out of line by stock, or blown out by gusty winds. The object of watling or double-winding them at the top with saplings, which makes a much more handsome fence, is to hold the tops of the stakes, and consequently of the fence, in a straight, even line.

In an Osage thorn single-row hedge, trained in this tapering form, the top of the hedge will not prevent either sunlight or rain from access to its outside growth, as would be the case with square or flat top training. There are specimens of square-top Osage thorn hedge in the west, the bottom of which is already thin, and in places open.

PRACTICAL SUGGESTIONS.

Strong, two-rowed hedges are much more suitable for large inclosures, to turn rampant animals, to bear severe stress of boisterous winds, or for any purpose where a very strong fence is necessary, than a single-row fence can ever become under the best possible management. The double-row will make the best fence for farmers generally, particularly where the farms and their subdivisions are extensive in area.

Single-row fence seems most suitable for vegetable and flower gardens, and nursery grounds, besides lawn and ornamental grounds, as before stated. It bears trimming better, and requires less ground for growth.

SETTING QUICKS IN HEDGE ROWS.

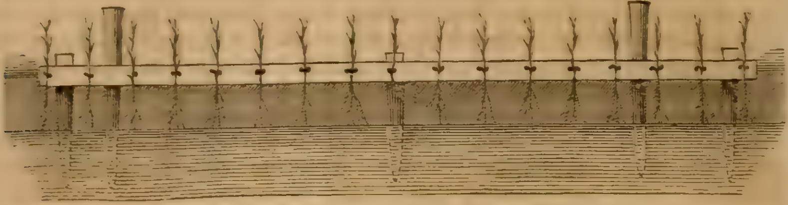
This hedge-row ridge, having been prepared in the fall as suggested, may be harrowed over once or twice, as soon as the frost is out of the ground in early spring. A mode of setting Osage thorn quicks, known as spade-setting, consists in opening a line of slits in the surface soil, at regular distances on the line of the intended hedge, with a long, narrow spade. The spade being thrust down a sufficient depth, is pushed forward from the operator, when an assistant inserts the root ends of the young quicks. There are serious objections to this mode of setting. The quicks are not set, but tucked in and often doubled back, the roots being placed between two flat surfaces, when the spade is withdrawn, and the slit closed by pressing the soil back against the quick with the foot, which process as certainly flattens the roots as a botanical specimen is flattened between the leaves of a book. This flat position and restricted direction of the young roots must retard the formation of an efficient hedge.

FURROW TRENCHES FOR DOUBLE-LINE QUICK ROWS.

For making the trenches a plow with a deep land-side is best, forming a deep furrow, smoothed on one side. A new mode of furrow-trenching and of setting Osage thorn quicks in the trenches is shown in Figure 6, which represents a cross section of double-row trenches on the crown of

PLATE VIII.

Fig. 7.

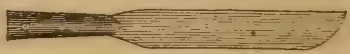


Setting guide.

Fig. 8

Trimming hook.

Fig. 9.



Trimming blade.

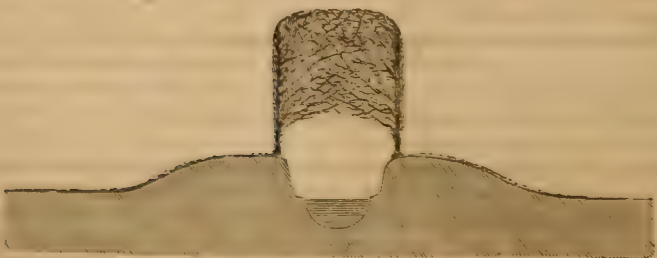
Fig. 10.

Pleaching hook.

Fig. 11.

Press pole.

Fig. 12.



Double hedge over water channel.

IMPLEMENTS USED IN HEDGE GROWING.

the ridge. Stakes are set the whole length of the fence line in the center. The distance between the quick rows is two feet. The trenching is commenced by first plowing a light furrow toward the center, which will rest on the space between the trenches. Next turn a light furrow on top of the first, depositing this also over the space between the trenches. Then plow a furrow out of the bottom of each trench, turning both furrows outward from the lines of the quick rows. By this process of taking two furrows from each trench, a suitable supply of mold is deposited precisely where it is most needed to fill in about the roots of the quicks, when these are set up.

The old mode of setting the quicks, at uniform distance between the rows, was by means of a line with colored strings tied to it at the required distances. The land side of the furrow was the support to stand the quicks against, and guide them in a straight line. But the land side of the trench was liable to be crooked, and the labor and time required were considerable. A more serious objection, however, is that some of the roots of the quicks are turned aside from their natural position by pressing against the wall of the trench. This misplacement of the roots retards their growth in some degree, but the injury is less than that of the same kind incident to slit-setting, by means of a spade. Another defect is that all the soil is turned out on one side of the trench, providing no mold to fill in on the other side of the quicks.

THE SETTING GUIDE.

As a rope or garden line cannot be kept straight, and the land side of single furrows is liable to the same objection, a tool has been devised which may answer the three-fold purpose of spacing the quicks as they are placed in the trenches, as a support to the quicks, and as a guide to keep them in line; these several objects being desirable, and even necessary, before and during the operation of filling in the soil, and earthing up the quicks. This setting guide will cost only a few cents and a little labor. It is made by taking a narrow strip of inch board or three or four inch batten, fourteen to sixteen feet long, and attaching to it three strips of hard wood, one in the middle, and one at each end, for legs, which should be sixteen to eighteen inches long. Figure 7 gives a side outline of this form as set for use, about one-third of its width from the land side of the furrow-trench. Vertical chalk marks can be made on this setting guide, or small pins of wood may be inserted at the distance the quicks are to stand in the rows, two feet being a good distance for a two-row hedge, giving one plant to every foot in length of the fence. Of course, the quicks in each row will be placed opposite the spaces in the other. The quicks in the figure are spaced one foot between, as for a single-row hedge. If holes are made at intervals of four inches, the entire length of the guide, pins can be inserted, and the quicks be set at any number of inches apart that is a multiple of four. By placing the quicks in the angles formed by the pins or pegs and the horizontal strip, they are supported in position on two sides, and can be placed as they are to remain in the trenches, with ease and rapidity. When the lines are properly staked in each trench, the stakes being set so that the guide may be against two at each time of its removal, there will be no sagging, nor any side-ways deflection of the setting guide or the row, while the quicks are placed and supported in a good form to have their roots properly extended and molded, and the soil filled in on both sides of the rows.

RESULTS OF CLOSE TRIMMING.

It is supposed that none but single-row hedges will be trained by the repressive process of trimming twice annually, for the quicks in hedge of this form will be slender in consequence of the crowding of the roots from thicker setting in the rows. Trimming does thicken the surface of the hedge by causing a stubbed, stooling form of growth, but this form at the top soon shades the bottom part, keeping out air, light, and moisture.

After a few years of close pruning, twice each year, inlaid hedges present a thin bottom growth. Trimmed hedges cannot well be trained more than two and a half to three feet high, a yard across at the bottom, while narrow at the top. Of these dimensions, a continually trimmed hedge is not always a safe fence as against jumping horses and cattle, and its ultimately thinned bottom opens a door for the inroads of *untamed swine.* On the other hand, pleaching causes a thick, bottom growth, thicker after pleaching than before, by the combination of old and of new growth, and while ample new growth is forming in the bottom the old saplings, now pleached layers, are still kept growing; and if not cut two-thirds through they will grow too much and prevent growth lower down, many of them sending up new shoots in all parts of the fence. The pleached saplings also add great strength to such forms of fence by combining an upright and an oblique, or an old and new growth, crossing and strengthening both forms of thorn material. The young shoots from the bottom of a pleached hedge tend outward in a degree toward the light, but the brush of the laid saplings can be spread wide enough to protect this growth, or so much of it as may be required, so that a properly pleached hedge, while making ample growth in the bottom also protects it. Hence a healthy growth of Osage thorn hedge may be made renewable for ages by successive and reasonable pleaching.

REPAIRING HEDGE FENCE.

A hedge that has been trimmed from five to seven years becomes so thin and inefficient as a fence in its lower parts, that it must either be laid or repaired. Such a hedge may be repaired by thrusting detached brush cut from the thickest places into the holes as compactly as this can be done and driving down stakes, or working saplings through it obliquely, according to the necessity of resisting swine, or straying hedge-breakers of any sort. The process of mending requires frequent repetition, when stock is grazed to any considerable extent near poor hedges, and laying will soon be found to be more economical than patching with repairs, however carefully performed.

HEDGING WITHOUT LAYING

consists in cutting back the quicks the first year at six to eight inches from the ground, cutting off the vertical shoots six inches higher the second year, and repeating the same process and distance the third season, when the hedge row will be about two feet in height. It is then allowed to grow another foot higher when the top growth is again carefully cut off, after which the hedge is kept down by close trimming in July and November of each year. This is hedging by negation, or repressing it instead of first encouraging growth, and then training so as continually to maintain it in the bottom equally with the top of the

hedge. The plan involves the performance of so much labor, and appears so little adapted to extensive hedging that we do not recommend it, believing that it would retard the extension of true hedging.

TRAINING HEDGE FENCE.

Osage thorn fence, when kept down by trimming, should be trimmed as soon as the spring growth, sometimes called the midsummer shoot, is completed. This may be earlier or later, according to the character of the season, but the interval of rest between the first and the second stage of the year's growth usually occurs before the first of July. During this interval of rest, directly after the first growth is complete, is the best time for summer trimming. The second trimming may be performed at any time between the falling of the leaves and the setting in of severe freezing weather, but no trimming should be done when the sap is congealed to any great extent by frost.

TRIMMING TOOLS.

Some persons may prefer one form of tool, others another. A variety might be suggested, but we sketch two only of the best for practical uses. Figure 8 represents the trimming hook, and Figure 9 the trimming blade. Both require handles from two to three feet long, according to the height of the operator. When the growth to be cut off is small, the hook with a shorter handle may be used with one hand, but in all cases when the shoots are thick and vigorous, the trimming blade is the most effective and the most convenient tool.

HOW TO TRIM HEDGE FENCE.

If, in the process of trimming, the shoots are cut toward the bottom growth of the wood as downward in an unlaid one, or against the leaning direction of the layers in a laid hedge, the ends from which the shoots are cut are more or less split, bruised, or maimed, and the result will be dead, stubbed ends. To avoid such injuries, all trimming should be performed by striking toward the tips, as upward with unlaid hedge, and in the direction the brush leans with such as have been pleached. The principle is the same in trimming hedge as in pruning by hand. The wood cuts will heal well, if they are smooth, and the new growth will start at the top instead of below the ends that have been cut.

PLEACHING HEDGE.

The season in which to pleach is not when the hedge is growing, but in the fall, between the falling of the leaves and the time when winter sets in. Osage thorn hedge should not be pleached during severe freezing weather, but pleaching may be done in mild weather, when there is but little frost in the wood, and in the winter in southern latitudes. In the northern belt, where the Osage thorn thrives, which is as far north as southern Wisconsin, it is not safe to pleach in winter. But if not done at the best time in the fall, this work may be performed before the buds swell in the spring, as early as the middle of March.

An Osage thorn hedge will attain a given size earlier in some localities than in others, according to the richness of soil, and other conditions affecting the rate of growth. Size rather than age, therefore, may de-

cide the question when to pleach. A hedge requires laying when the stems of the saplings average two inches in thickness at three feet from the ground. Hedges that grow slowly, as they will in wet ground, if they grow at all, may require laying when the saplings are one-fourth smaller, though no younger, to thicken the bottom of the fence. Osage thorn quicks may attain this size in six or seven years. When the saplings are much larger, the labor and expense of pleaching will be proportionally greater.

HEDGING TOOLS.

The tools required for pleaching or laying are few and simple in form. Figure 10 represents the pleaching hook, the point being somewhat beak-like in form, and the handle made of wood. The uses of the four-toothed press pole, Figure 11, will hereafter be stated.

REPAIRING HEDGES FOR FIRST PLEACHING.

There being no horizontal or oblique old layers to pull out when a hedge is to be first laid, the process of preparation is very simple. It consists in trimming off such straggling side growth as may be in the way of the workmen; setting the stakes if a single row or a staked hedge is in hand, and cutting off saplings close to the ground where there are more than one to a foot. The thorn brush thus obtained may be used to fill in at the bottom, and in thin places.

LAYING SINGLE HEDGE.

In single-line hedge the saplings are so wound between as to press against the stakes, the tips or brush ends being all turned to the beveled or slanting side. For a single-thorn hedge, the form of Figure 8 is preferable. In this form the tips or brush are turned equally and alternately on both sides of the stakes, and thirty degrees is about the right inclination of the saplings when pleached. The hedge being commenced right by thrusting brush down among the live-shoot stakes to rest the first layers upon, the layers being placed at the same angle throughout, the work proceeds to completion. To prevent breaking where the saplings are cut and bent in the act of laying down, take care to cut two-thirds off, as this prevents too much sap from going to the layers, and causes a thicker and stronger degree of new growth from the bottom of the hedge.

RELAYING HEDGE FENCE.

This work is the most difficult of all hedging operations. The first step is to trim away the straggling side-shoots, as just described. The hook (Figure 10) is suited for this work, gathering straggling growth better than a straight hedge tool. Next pull out the old layers, drawing them out by the butts, or lower ends. This will be the tough part of hedging work, and it seems practicable to perform it by an easier, if not a quicker, process, by the use of horse-power. A boy can lead a horse, with a suitable chain attached to the whiffletree, while a man attaches the chain to the lower ends of the old layers, as fast as he comes to them; and so on from one end of the hedge to the other. The old stuff, both live and dead, being cleared out, the stakes are set a few inches one side of the line of saplings, and the laying is then proceeded with, by bend-

ing down the saplings one by one, cutting each as much as two-thirds off, about three inches from the ground, this height being required to facilitate the bending to the stakes without breaking off the remaining third, by which the saplings are still attached to their roots, and through which they are to be kept alive. This very important process should be performed with deliberate care, and as fast as each sapling is laid down, the stub joined at its base by cutting is to be cut off by a short side-blow with the hooked edge of the pleaching-hook. The first cut of two-thirds, to facilitate laying down, is made with the reverse edge, seen in the projection on its part, Figure 10. It is quite necessary to cut off the stubs, or the young growth to come forward will be from the tips of the stubs instead of from the ground, where it is required. If left uncut the stubs will also prove great obstacles to the work when, in six or eight years, the laying down process must be repeated.

PLEACHING STOUT OR TANGLED HEDGE ROWS.

When the saplings are large there will be found much spreading brush on the sides of the tops, and it will be found difficult to crush this growth on the side that goes under in laying the sapling in the hedge. It can be cut off when brought down low enough, but this will be found slow work. When the vertical stem-growth is three or more inches in each sapling, the work may be reduced. The strongest under-branches must be cut off to admit of laying well. But the hedge (double-row hedge being now under consideration) being ready for laying, three men, one to cut and two to pull down and press, can get on proportionately easier than one alone.

Two men use the press-pole, represented in Figure 11; the other uses the pleaching-hook. The pole is thrust through behind each stout vertical sapling, when both men pull gently and equally. Thus bent back a little, the third man cuts it two-thirds through, cutting obliquely downward with the pleaching-hook. The two men steadily press the sapling down to the laid part of the hedge, the teeth in the pole keeping it from slipping sideways, and also serving to guide it to its assigned place, when the men bear heavily on the pole, forcing down the sapling, and crushing back the brush on its under side, till both are in the desired position. The force here employed is threefold as great as one man can exert in the same work. Consequently, much of the trimming from the under side, to let the brush sapling into its place, is saved, while all the men are enabled to work with less hindrance from thorn brush, and the hedge is made thicker and stronger. The man with the pleaching-hook cuts off the stubs, and attends to any trimming that may be required, while the others are at work pressing down the sapling brush. A tough pole is necessary for this work, and the process appears more workman-like than for two men to bend down Osage thorn saplings with pitchforks, thus wasting half their power.

HERRING-BONE HEDGE.

We have spoken of pleaching double-row hedges, by crossing the saplings alternately, when each sapling, and each row, by the force derived from thorns and roots, severally and reciprocally supports the other, and resists every tendency to displacement. This form of fence may be made even stronger by placing a continuous line of long, medium-sized, rough-trimmed saplings in the angle or crotch above the line where saplings cross one another. No stakes are required. This

form of thorn fence is similar to the old time "herring-bone" rail and stake fence, and the name "herring-bone hedge" would not be inappropriate.

Another plan of forming two-row hedge, when laying it, may here be noted. The saplings, standing two feet apart in each row, are left at intervals of six feet in each line, to form live stakes by cutting the tops off. There will be layers enough when the hedge is again laid to admit of these stakes being cut out if they become stooly where previously cut off. About half the saplings may be laid along outside one stake, then inside of the next, and thence angling across to the other row; so of the saplings on each row, the ends of the brush protecting the young growth below the place where it hangs over on either side. The other half of the saplings is laid to cross one another in the center of the hedge, as in the herring-bone form, without regard to the stakes. The stakes and the layers can easily be taken out when relaying becomes necessary. The stakes are the means of adding side-walls, as it were, to the hedge. The hedge so made cannot be otherwise than very strong, from combining the herring-bone and staking features, and the combination affords a choice of two plans of stout double-row hedge, either of which is comparatively easy of construction and subsequent management.

TRIMMING WITHOUT LAYING, AND LAYING WITHOUT TRIMMING.

A hedge that is left without laying seven years will have been trimmed fourteen times. An average hand will trim a mile in twelve days. Multiply twelve by the number of trimmings, and we have a charge, at a dollar per day, of $168. The hedge so trimmed must be cut off at the ground, for it cannot be easily or tolerably well laid after seven years of close trimming. Hence, at the end of a seven years' course of trimming, we have an interval of two years without any fence, except the old brush lying beside it, to protect the young growth that is springing from the bottom to form the new hedge. With the untrimmed double-row hedge we have a little more shade, far more protection against wind, no liability to trespass with jumping animals, a good fence during our life-time, little or no expense for trimming; but, at the end of the seven years, there is the expense of laying. A man will prepare, stake, and lay four rods of stout hedge per day, which is a dollar for every four rods, or eighty dollars per mile, in seven years. It will be seen that a course of seven years' trimming costs fifty per cent. more than once laying with no trimming; and, if we charge one dollar per mile per annum for a little trimming away of straggling shoots from the sides of the tall hedge, the result will remain substantially the same.

HEDGE AND DITCH FENCE.

As generally understood by those interested, there are large areas of both low and clayey soils in Missouri, Iowa, Indiana, Illinois, and Minnesota, where open ditches are required as water-courses. In some of those States several of these ditches have been made as a means of partial surface drainage; and many more would be made, some of them on division lines, where the ground is suitable, if the water-courses could be protected against damage to their sides by the treading of animals.

There are many ditches which are water-courses in the spring, but which dry up, and remain dry, during most of the other three-quarters of the year, except during and for a brief time after drenching rains,

but which might be rendered more valuable could they be made to hold stock-water during a greater portion of the warmest season of the year. Shading, as is well known, retards evaporation, and these open ditches can readily be shaded by growing Osage thorn hedge-rows on either side, and when five or six years grown, or before, if the growth is vigorous, laying them down obliquely across the ditch, making a hedge over the water-channel, as shown by Figure 12.

The thorn brush would also protect the ditch banks against injury by animals in seeking water. The roots of the horizontal saplings and their living growth of thorn layers prevent the hedge growth from falling into ditches so fringed and shaded. If, in the course of years, such ditches should require cleaning out, the layers might be readily cleared away, and a new arch supplied from the fresh, vertical growth which had been allowed to form in readiness. Another important advantage of such shading would be that the shade of the horizontal thorn brush would keep the frost in till the general atmospheric temperature would be sufficient to thaw it out of all merely shaded ground. In this way the sides of the ditches and the tops and insides of the ditch banks, or ridges, may be secured against the crumbling and abrasion to which they would be subject by frequent freezing and thawing. Such protection and shading effects of horizontal hedges would also be advantageous in connection with outlets or open drains, particularly with the drains.

THE ESPARTO GRASS.

Rags have failed to supply the demands of paper-makers in this age of printing. A cheaper, more abundant fiber is essential to the undelayed advance of civilization itself. Straw is cheap and abundant, suited to the manufacture of low grades, but undesirable for the better qualities of printing paper. Wood has been used to some extent, and the swamp cane of the south (*Arundinaria gigantea*) is coming into extensive use as paper material.

While these and other fibers should be tested, there is one that has maintained for centuries a high reputation for various useful purposes, and within a few years has almost monopolized the European market for paper material—the *Spartum* of Pliny, the esparto of the Spaniards, known by various scientific synonyms, as *Macrochloa tenacissima*, *Stipa tenacissima*, and *Lygeum spartum*. It is also popularly known in Spain as the atocha plant, and in Algiers as alfa. It flourishes in Spain and Portugal, in Algeria, and in North Africa. It is said to be found also in Naples, Sicily, and Crete. The principal sources of supply are the provinces of Granada, Murcia, and Almeria, on the Mediterranean coast of Spain. Its fiber is exported also from the French port, Oran, in Algeria, in latitude 35° 44′ north, immediately opposite the region yielding it most abundantly in Spain.

It is interesting to note the fact that New Mexico produces a plant the fiber of which appears to be similar to that of the Spanish esparto, as seen in the museum of this Department. It is known to botanists as *Stipa tenacissima;* was obtained in 1851 by Charles Wright, of the Mexican boundary commission, and may be found among the Department botanical collections. The latitude of the northern section of New Mexico is the same as that of southern Spain, the climate in some respects similar, being warm, dry, approaching aridity, and the soil is suited to similar products.

The esparto is presumed to be identical with the *spartum* of the Latins, described by Pliny as useful in various arts of the Carthagenians in their first war in Spain. At that period the mountains of Spartacus Campus, including the territory between Grenada and Murcia, were covered with this spontaneous growth; and its uses in the Iberian peninsula were represented to be innumerable. The historian expressed regret that its great bulk prevented its transportation for a greater distance than thirty leagues, and its consequent universal dissemination as a valuable material for many industries. The region referred to is the precise locality of its greatest production now.

HABITAT OF THE ESPARTO.

It grows on sandy shores, and on the gravelly hills of the interior, upon soil so poor as scarcely to be capable of any other growth. It is a spontaneous product, requiring and receiving no care whatever, but becoming more vigorous and abundant with yearly or semi-annual gathering. The harvest is not obtained by cutting, but by pulling or separating from the root, a labor of little difficulty if performed at the right time, which is the month of May or June at or near the coast, and

July at the higher elevations of the interior. It is particular in the choice of soils, growing in one locality in great luxuriance, and in another enduring a dwarfed and feeble existence, as seen in isolated patches or tufts. Above an altitude of three thousand to three thousand five hundred feet it is rarely seen, and disappears in the vicinity of the line of winter snows. It may be said to be very hardy, though not so much in enduring severe frosts as in thriving in continual drought and great poverty of soil.

It grows naturally in tufts or clumps, and is gathered by pulling. If collected green, it becomes a transparent fiber of little value; if too dry, the constituent elements of silica and iron are with difficulty removed.

The gatherer protects his legs and hands with boots and gloves, and then twists the stem around a stick to obtain a better purchase. The time of harvest is from the middle of May to the middle of June. After being pulled it is collected into bundles, which are formed into a heap and left for two days. On the third day it is spread and exposed to the heat of the sun till dry, then rebundled and placed under shelter, and afterwards macerated in sea-water if it can be obtained, again dried, wetted, and beaten before it is ready for use.

NATURE AND USES.

The esparto of the interior is longer and whiter than that of the sea coast, but thinner, and of less strength.

It is estimated that fifty thousand persons are employed in the collection, preparation, and manufacture of this fiber in southern Spain. Large quantities of esparto thread are shipped to France, mainly to Marseilles, where it is used in making carpets, ropes, baskets, and packing fabrics. At Aquilas it is used for rope-making in place of hemp, and is crisped to imitate horse-hair for mattress material, for which purpose it is highly prized, being very durable, and not liable, it is claimed, to become a harbor for vermin.

As cordage it is regarded now with as much favor as in the times of the Carthagenians, from its valuable property of resisting decay in constant exposure to moisture. A considerable trade is carried on with the Indies in a style of shoe or sandal of esparto, "found very useful in hot, rocky, or sandy soil." The peasants, in a portion of Spain, use no other *chaussure.* It is regarded as graceful and classical, if somewhat rustic. This fiber is also used in the Scotch carpet trade in Kidderminster and Brussels goods.

Great improvements have been made in its preparation for paper-making. A process is employed for extracting the glue-like matter it contains, leaving the fiber clean and ready for use. Formerly thirty or forty per cent. of rags were used in the manufacture, but an excellent paper, strong and of fine surface, is now made without any admixture of linen or other material.

Of all the substitutes for rags tested and used at present in Great Britain, the esparto scarcely has a competitor. Some of the largest British papers are now printed upon it. Experiments have recently been made in softening the fiber, by passing it through machinery without the aid of caustic soda. So advanced are the processes by which it is converted into paper, that it has been claimed that a cargo arriving in London in the morning has been converted into paper during the same evening.

Its chemical constituents are said to be: yellow coloring matter, 12; red matter, 6; gum and resin, 7; salts forming the ash, 1.5; paper fiber, 73.5.

The quantity imported into Great Britain has reached the following figures: 1864, 43,403 tons; 1865, 51,570 tons, (£269,030;) 1866, 69,833 tons, (£311,868.) The entire importation of paper material, of all sorts, during the same years, was 67,819 tons in 1864, 71,155 in 1865, and 94,985 in 1866—esparto constantly increasing its relative proportion, and attaining a maximum of more than seventy per cent. of the total foreign supply.

PROGRESS OF THE ESPARTO TRADE.

The Department has had, for several years, more or less correspondence with the United States consuls in Southern Spain on this subject, and has received very full accounts of the progress and condition of the esparto trade, especially from Mr. Frederick Burr, United States consular agent at Adra. When the recent demand sprang into activity, the fiber was obtained only from the hills and on the coast; but as consumption quickened the demand and advanced the price, the cost of carriage through a region almost destitute of roads was amply met, and the business of gathering and forwarding extended forty miles or more into the interior. The mode of transit is by "bullock carts." The provinces of Almeria and Murcia have furnished the greater portion of the supply.

In 1864 the cost in the interior was only four reals, or fifty cents, per quintal, while the freight to the coast was ten reals more. At that date the average price, on shipboard, was about £4 2*s*., or $20 50, per English ton. In the previous year it was purchased at about two-thirds that price. Prices have been constantly advancing since that date.

The crop is purchased annually of individuals or municipalities owning waste lands on which it grows by merchants or speculators, who employ the peasantry to collect the grass and convey it to local posts, ready for shipment by carts or on the backs of mules or donkeys. Fortunes have been made by the proprietors of these hitherto worthless lands, and by the purchasers of them, as also by the traders in this species of merchandise.

Mr. Burr assumes that a vast breadth of country in the United States, in the same latitude in which it is found in Spain, is adapted to its growth. The following extracts are made from his report to this Department.

There are two classes of this plant, the "atocha," properly so called, and the coarse or "bastard" atocha. The latter is much superior in height, the grass growing to the height of about three feet, but it is inferior in quality and in strength of fiber, though used for several purposes.

The atocha grass, which is called esparto, is not cut like ordinary grass, but is pulled up from its socket, as it were, for it very readily separates from the plant a little above the roots, which it is necessary to leave undisturbed in the ground. The thin, wiry grass thus gathered is spread out to dry in the sun, and is the article known in Spanish as esparto.

The esparto grass, from the length and strength of its fiber, and the facility with which it may be twisted into ropes, and easily woven (or rather plaited) into matting, forms a cheap and useful article for many ordinary purposes. In the great mining district of the Sierra de Gador, in this province, and in that of Cartagena, and most others in Spain, all the ropes used in the mines are made of esparto. These ropes are very slender—about one and a half inch in diameter—yet they serve perfectly well for the descent and ascent of the miners, as well as for raising the ores and rubbish from below, and the baskets used in the latter operation are also made of the esparto. As the more mountainous parts of Spain are nearly destitute of cart roads, the chief transportation is on the backs of mules and donkeys, the articles carried being always packed in baskets or in panniers made of the esparto grass. All kinds of matting for houses and other purposes are also made of this useful article.

Besides these coarser applications, very neat and pretty baskets are made of this

grass, and also, of one species, a fine and even elegant matting for houses of the better class, as carpets are not used, and indeed are not desirable in this hot southern climate. For this purpose the grass used is dyed of various colors, and it is then woven into various simple but tasteful patterns. This superior matting has much the same appearance as carpets, but is infinitely preferable in a warm climate both for coolness and for cleanliness. Indeed this Spanish matting is much prettier than the cane matting used in all European houses in the East Indies, though it is not so durable as the latter.

The atocha plant flourishes at Oran, on the opposite coast of Africa, in latitude 35° 44′ N., and, it may be said, generally, in all the southern part of Spain; sparingly, even as far north as Madrid, (latitude 40° 30′,) where one of the principal streets, leading to the environs, is called "Calle de Atocha." This would place the geographical zone of this grass from 34° or 35° to about 40° north latitude, according to my present information, for it may possibly extend still further both north and south. But it is important to observe that the most abundant region—that in the provinces of Almeria and Murcia—which now furnishes the chief supply of this article—is situated adjoining to and between the thirty-seventh and thirty-eighth parallels; and that it is here where it appears to grow in the greatest abundance and luxuriance. It is needless to remark that the above zone is, in Europe, chiefly occupied by the Mediterranean Sea, while in the United States it embraces the entire breadth of a vast continent.

Climate.—The climate of the south of Spain is the hottest in Europe, particularly that of the provinces on the Mediterranean coast; nor is heat alone its characteristic, for it is equally remarkable for its extreme dryness and want of rain; so much so that the cultivation of large and fertile tracts depends entirely upon irrigation. In what is called the Secanos, or lands somewhat elevated, and thus dependent entirely on the rains, I have known the crops to be lost for three years in succession, so little rain having fallen. In fact so arid are many tracts in the south of Spain that they present, though on a miniature scale, a sort of parallel to the deserts of Africa and the east. This resemblance often struck me when I first arrived in Spain, after a residence of some years in India and oriental countries.

On and near the coast the temperature during the hot summer months is usually 85° to 90° Fahrenheit,* and in the winter months the climate is so mild that the thermometer seldom marks less than 45° to 50° Fahrenheit. A few miles inland among the mountains, however, the climate is much colder. The climate of this part of the Spanish coast can, probably, be best inferred from its vegetable productions. Thus the sugar-cane flourishes here, and there are many and increasing sugar manufactories in this part of Andalusia. In one locality, the plain of Motril, thirty miles west of Adra, the cotton plant has been cultivated with some success, though upon a very small scale, not being found profitable. All along this coast, too, groups of the date palm are occasionally seen. This elegant tree, though now neglected and diminishing in numbers, was, most probably, planted by the Moors during the period of Arab dominion in Spain. Indeed it is well known that the numerous and venerable olives which abound in this neighborhood existed on the confiscated property of the Moors at the time of the conquest of Granada. Among other semi-tropical productions of these provinces may be named the nopaul and the aloe, which are abundant, especially along the coast, though they are not equal in size and luxuriance to what I have been accustomed to see in India and the tropics.

Elevation above the sea level.—The naturally hot and arid climate of the south of Spain is modified in a very remarkable manner by the occurrence of lofty mountain ranges in the interior. In Andalusia especially, we have the Sierra Nevada range, the highest summits of which rise up almost to the curve of perpetual congelation. Thus, from plantations of sugar-cane near the coast may be seen, in the hottest summer months, patches of snow which never melt, and at a distance of not more than thirty to sixty miles. These snowy patches mark the lofty peaks of La Veleta and of Muley Hassan, which rise, respectively, 11,420 and 11,700 English feet above the level of the Mediterranean. Thus, in traveling a few miles inland, and even without losing sight of the sea, a difference of climate may be experienced equivalent to that of many degrees of latitude, while a total change may be observed in all the vegetable productions of the soil.

In considering the natural climate of the atocha, the circumstance of elevation above the sea-level is, therefore, most important, and I have, fortunately, been able to fix the elevation and consequent temperature, which marks its upward limit, with considerable precision.

It will be seen that we have here two distinct climates—that of the coast and that of the mountains. In the former, except as a somewhat rare phenomenon of a few hours in duration, snow never falls. But in the latter, snow is abundant for many months in the year, and lies for very long periods, according to the elevation, till, on the summits of the Sierra Nevada, it never disappears. The falls of snow are generally

* That is, the temperature in-doors and in the shade, as usually taken.

limited to a certain zone of altitude, above which, in winter, we usually see all white and spotted, while below, in most cases, nothing falls but rain. This altitude, especially near the coast where I reside, I have taken some pains to fix, (for it may not hold good in the interior,) and find it to be, very approximately, about 3,500 feet, that is, near the Mediterranean, and where the warm exhalations of that sea greatly modify the temperature. I should place the usual limits of the snow at 3,500 feet above its level; but in the interior, if only fifteen or twenty miles distant, the snow level is, doubtless, somewhat lower.

Now it is very important to our present purpose to observe, as I have lately done when considering the subject, that it is at about this elevation where the snow usually commences, that the atocha plant ceases to grow.

It will be seen, therefore, that the atocha, though a hardy plant, growing here indifferently in the plains and on the mountains near the coast, is confined pretty much within certain limits of temperature, and will not bear the cold. In fact it requires a hot and somewhat dry climate, such as I have described as prevailing in the south of Spain. So far as this climate prevails the atocha seems to grow equally on the mountains and in the plains, but its luxuriance is checked in approaching the altitude of the winter snows, and at about that elevation its growth ceases altogether.

Congenial soils and geological structure of country.—Although the growth of the atocha extends over a large expanse of country, it is only in particular situations that this grass attains that degree of luxuriance and abundance which is essential to render it important in a commercial point of view. This indicates that it is eminently a plant that seeks and requires a congenial soil. On this subject, in addition to my own partial observations, I have made many inquiries, and find that there are soils on which the atocha will not grow at all; others on which it grows but sparingly, while on others again it is the prevailing *weed* or product of the soil, being spontaneously produced by nature in vast abundance.

I have before mentioned the mountainous nature of this country, and, as soils are merely the detritus of the subjacent and neighboring rocks, I consider that the most general and, perhaps, exact idea of those in this district, will be obtained by a brief reference to its geographical structure, which I now proceed to describe.

The Sierra Nevada range, which, under different names, may be said to determine the configuration of the coast of Spain from the straits of Gibraltar, west, to the plains of Murcia, east, consists, in its highest and central portion, of a vast mass of micaceous schists below, approaching to gneiss, while, on its upper surface there reposes an enormous mass of shaly rocks, often soft and decomposing into a stiff blue clay. These shaly rocks, the thickness of which is very considerable, are covered, in places, by a dark sub-crystalline limestone, generally forming the upper part of the mountains, and constituting pre-eminently the metalliferous or lead-producing rock of the south of Spain. These three rocks, *mica slates, shales,* and *limestones,* at various elevations, from the towering heights of the Sierra Nevada to minor ranges not more than fifteen hundred to two thousand feet in height, constitute all the elevated portions of the provinces of Granada, Almeria, and Murcia, while the plains along the coast and the inland valleys generally consist of yellowish tertiary marls. These marls are sometimes covered by a thin superficial deposit of detritus of more recent date, which, when of a siliceous nature, or cemented by siliceous matter, form a very sterile soil almost destitute of vegetation. I have never been able to trace any line of demarcation between the micaceous schists and the superincumbent shales, and am inclined to think, therefore, that they all form one great series, the lower part of which has been thoroughly acted upon by metamorphic influence. Nor is there any distinct line between the shales and the superincumbent limestones, for near the line of junction there are frequent alternations of the two rocks, till, as we rise in the series, the limestones prevail. Quartzose rocks and their usual concomitants, siliceous sands, do not, that I am aware of, occur in all this district. Three soils, therefore, prevail in these provinces, argillaceous, calcareous, and argillaceous-calcareous, from the frequent admixture of the two former, and also from the wide occurrence of tertiary marls in the plains and valleys.

This sketch of the geological structure of the country will, I think, give a sufficient idea of the general nature of the soils in the south of Spain, in which the atocha flourishes with most luxuriance. It may, therefore, be found useful in selecting the districts in the territory of the United States, where similar soils and conditions prevail, and which are thus best adapted for the introduction of this semi-tropical species of grass.

The subject of soils is, however, so important that, in addition to the above general considerations, and to what I have myself observed, I have made many inquiries of others, from which the following seems to be the general result:

Two kinds of soil are considered decidedly adverse to the growth of the atocha—a wet or marshy soil and a pebbly soil, I mean any of those numerous alluvial soils on the surface of which pebbles are abundantly scattered.

Reddish-colored soils, or those much impregnated with oxides of iron are not considered favorable.

Calcareous soils are considered to produce good esparto, and of a very strong fiber.

Argillaceous soils, whether those produced by the decomposition of shaly rocks or those formed by the wide deposition of tertiary marls, are impregnated with nitrous matter or saltpeter, and are considered favorable to the growth of the atocha, the grass being shorter but the fiber stronger.

The leading facts in the production of esparto may be stated as follows: 1. The atocha grass requires a decidedly hot and a somewhat dry climate. 2. That it grows equally well in the plains of the coast and the interior and in the mountains, but is strictly limited to a certain moderate elevation. 3. That it flourishes equally both in calcareous and in argillaceous soils, and in those soils where both calcareous and argillaceous matters are naturally blended. 4. That besides several soils which may be considered unfavorable, there seem to be others which are decidedly inimical to its growth.

Season of the crop and quantity produced.—The atocha which grows in the plains comes early to maturity, and the grass is, therefore, plucked or gathered in May and June. But in the colder climate of the mountains the crop is much later, the grass not being gathered till July and even August.

The proper time for obtaining the seed is considered to be in June, and, as it falls and perishes rapidly, the operation will present some difficulty, as it must be executed with all possible rapidity, or the critical time for its collection will have past. The best time for gathering is in the month of June and the early part of July.

Although of a dry and wiry nature, the esparto, like all other kinds of grass, requires drying in the sun, by which it loses about one-fourth of its weight. After drying it is tied up in bunches and conveyed to the nearest shipping port, where, from the month of June to the end of the year, numerous vessels, chiefly English, are employed in its shipment.

The quantity of esparto produced from a given extent of land will vary greatly, the grass being, in some places, very luxuriant and abundant, while in others, where the soil is less congenial, it is more thinly dispersed in tufts and patches. People practically acquainted with the business, with whom I have spoken, seem to think, however, that in a good congenial soil from two hundred to three hundred quintals may be obtained from a fanega (5,500 square yards) of ground; while in less congenial soils the product would hardly amount to one hundred quintals—perhaps a great deal less.*

This grass seems to last for an unknown number of years, so that, where it has taken possession of the soil, it becomes a perpetual growth. Thus, in any soil congenial to its growth, the atocha is self-propagating, and without further cultivation or attention of any sort it furnishes a never-ending annual crop of esparto.

All persons with whom I have spoken agree that the esparto improves by a regular yearly gathering, and that the plant is found to become stronger in consequence. But the gathering requires some little care. The grass (which readily separates) must be plucked up, but without pulling up or injuring the roots. If the roots be disturbed, as may be the case, by careless or ignorant people, or those who greedily seek to increase their wages by pulling up the entire plant, thus augmenting the apparent weight of esparto gathered, the atocha is destroyed, and no more grass will be gathered on that spot. This contingency, however, does sometimes happen from the rapacity of the laborers employed—their payment being by weight. The necessity of providing against such wanton destruction will be evident enough from what I have stated, and particular caution should be observed in this respect during the early years of the introduction of the atocha into America, and while the propagation of the grass may still be confined to very few localities.

Recently official inquiries concerning its use in Great Britain have met with the following response from the United States consul at Newcastle-upon-Tyne, England:

UNITED STATES CONSULATE, *Newcastle-upon-Tyne, May* 15, 1869.

SIR: According to your request I have instituted inquiries relative to the possibility of transplanting the esparto grass for culture to America, and the economy of its use in the manufacture of paper.

I have communicated with Dr. Hooker, director of the royal gardens at Kew, on this subject, and with Daniel Oliver, keeper of the royal herbarium, both of whom have responded most kindly. I have also received communications from Spain and visited one of the oldest and most successful paper-mills of England, where the esparto grass is exclusively used. There are important points of information that I have not yet received, such as the rain-fall, degrees of heat and cold, &c., of the best esparto-producing districts.

The soil adapted to its growth is a very sandy soil, and slopes or hillsides (not too steep) are said to be the best, in a warm but not too dry climate.

* Mr. BURT expresses a doubt as to the correctness of this estimate, as the land is never measured. Ten or more tons to the acre is probably an excessive estimate.

This grass is gathered or harvested by pulling, not by the roots, but by a quick jerk of the hand to disjoint it above the roots, so as not to destroy the latter, and also to avoid a mixture of the hard, woody portion of the plant, which would have to be separated from the grass before suited for use at the paper-mill. The hands must be protected by heavy gloves, as the grass is very sharp. Considerable skill is required in pulling the grass without destroying the roots. If properly gathered, there is no woody fiber to be rejected in the process of manufacture.

The grass is dried just as hay would be, and bound in bundles by ropes twisted from the grass itself, and then is ready for the paper-mill. It costs from $20 to $30 per ton in England, in Spain about $5 less per ton. Last year the amount imported into England was 95,000 tons.

The process of manufacturing paper from this grass is no more difficult than from rags, and far more pleasant; no infectious or contagious diseases or poisonous insects are carried by it, and the processes are so similar, except in the amount of chemicals required, that a description is almost needless.

I have been through the works of Messrs. William Hurry and Albert Richardson, at Jarrow-on-Tyne, Durham County, England, and these gentlemen kindly pointed out all the steps in the process, and gave me specimens of the grass and paper. They produce thirty tons of paper per week, using from fifty to sixty tons of esparto grass. No rags are used. The average cost of the esparto is $25 per ton. The machinery is propelled by a one hundred horse-power steam engine. Eighty-three women and girls are employed in sorting and boiling the grass; fourteen men and boys in washing and beating; thirty in finishing; seventeen on machines and cutting; eight mechanics; six engineers and firemen; and ten ordinary laborers—one hundred and sixty-eight in all. This estimate includes the manufacture of all their own chemicals.

The first step is the assorting of the grass, or separating it from roots, weeds, and flowers. Fifty girls are needed for this part of the work. The grass is laid upon tables of wire, so that all small bits of dirt or leaves may fall through as the work of separation goes on. The loss of weight sustained in this process is three to five per cent.

The grass is then put into large sacks and goes below, where it is put into boilers. Formerly the boilers were open, broad, circular vessels, but are now cylindrical and closed, so that a pressure of steam of twenty to twenty-five pounds to the square inch can be given to add to the effect of the chemicals. The boiling is by steam. In these boilers ten per cent. of caustic soda (N. O. A.) is introduced; that is, ten pounds of caustic soda to one hundred pounds of esparto grass, more or less soda according to the fineness or coarseness of the grass and the time given in boiling. The grass is boiled ordinarily five or six hours in the soda, being kept revolving or stirred in the boiler. The water is then run off and pure water supplied, and the grass again boiled for about an hour, to get rid of the resinous soap formed in the first boiling by the gum of the plant uniting with the soda. It is further washed with cold water and then discharged into large oval tubs or vats, and again washed with pure water. Then bleaching powder is added—two to two and a half hundred-weight, containing thirty-five per cent. of chlorine, (chloride of lime,) to a ton of esparto. It is revolved in three bleaching tubs till white, the tubs containing 500 pounds to 1,000 pounds each. Four to eight hours are required for this process; four or five hours will be sufficient unless it is thought desirable to use a smaller quantity of bleaching powder. The fiber, when thus bleached white, is pressed to free it from the bleaching liquor, and then placed in the beating engines, where it is washed for half an hour to free it from the remaining bleaching liquor, and then revolved in the beating engine the same as rags are treated, until it is reduced to a sufficiently fine pulp. The size, alum, and color, (when color or toning is required,) are added, and the pulp is run off into vats or reservoirs ready for use.

In reducing the pulp to paper, my attention was called to but one point of difficulty not encountered in reducing rag pulp. This occurs just after the pulp changes from the liquid state and takes the sheet form. The material at this stage is less tough and tenacious than when made from rags, and the difficulty is in getting it to enter the press-rollers. But a little management and experience overcomes the difficulty, and the paper when finished is even stronger than that made from rags.

The amount of paper produced is fifty to fifty-five per cent. of the weight of the esparto grass as it reaches the mill. The loss of weight is as follows: three to five per cent. roots, weeds, flowers, &c.; twenty-five per cent. extractive matter soluble in the caustic soda, and twenty per cent. destruction of fiber in bleaching, and mechanical loss.

All qualities of paper are produced except the very thin writing paper, which may be produced with a little more mechanical skill. I inclose samples of the paper from Messrs. Richardson & Co's. mills. No. 1 is an excellent quality of white printing or book paper; No. 2, toned printing or book paper; No. 3, account-book paper; No. 4, a specimen of the best paper that could be made from esparto grass in 1860, which was manufactured by Routledge, at Eynsham, Oxfordshire. Messrs. Richardson used a mixture of rags at first, which can be done in any proportion, but for the last three years they have used only esparto grass. They procure the grass from the east coast of Spain, from

Cartagena to Almeria; the best comes from Almeria. They have used a little from Morocco and Algiers, but it required more soda and bleaching powder, and never became so white as that from Spain. The esparto grows not only in Spain and North Africa, but in various localities along the Mediterranean, in Italy, Sicily, Sardinia, &c., and Portugal.

But the question which most of all interests Americans is its propagation in the United States. Dr. Hooker has written me that he has no doubt but that the esparto grass would thrive in the United States, and he strongly advises that the introduction be made by seed, not roots, and says it should be started in the nursery and the young plants set out afterwards. Mr. Oliver, who is also one of the best botanists in this country, thinks one of the two species, *Lygeum spartum*, (soft,) being a creeping rhizomatous grass, might be transplanted by being sent over in Wardian cases well rolled in sand, or in cases filled with sandy soil and buried in nearly pure sand. The other species, *Macrochloa tenacissima*, is supposed to be cæspitose, and he thinks this mode of packing might not suit it so well. He also recommends trying seed.

If the *Lygeum spartum* is a creeping rhizomatous grass it would be likely to spread very rapidly, and once rooted, a few plants would soon cover a large tract of country I send you some samples of both species of the grass. No. 1, best quality of grass, clean, ready for use; No. 2, specimen taken where the previous crop had not been gathered, so that the dead grass is mixed with it, but the latter decomposes and disappears in the process of manufacture, and only lessens the per cent. of paper per ton; No. 3, specimen contains butts of the grass and roots that should not be gathered with the grass, also some heads; No. 4, the same of the other species; No. 5, wild sage, often found growing with the esparto.

I remain your obedient servant,

J. W. McCHESNEY.

Hon. HORACE CAPRON, *Commissioner.*

IMPORTS INTO THIS COUNTRY.

Small quantities of esparto have been brought to this country. It has been found that the import duties are practically prohibitory, otherwise large quantities would probably be used.

In 1864 thirty-three tons were shipped to the United States from the port of Malaga. The following extract of a letter from the firm of Loring & Co., of Boston, will give an idea of the value of this fiber to the country, if it could be acclimated here:

During the years 1863 and 1864 we were induced to make the experiment of introducing the esparto grass as a material for making paper, and imported between three hundred and four hundred tons. We found it admirably suited for the purpose, but the heavy duty imposed on it, \$5 per ton, because a fiber, and ten per cent. ad valorem, and the increased duties on the chemicals required for its conversion into pulp, were greater burdens than the article could bear, and we were compelled to abandon the business. The consumption in Great Britain has, in the mean time, run up to over seventy-five thousand tons per annum, and it is not only used extensively in all the white paper made, but likewise largely in the manufacture of papier mâché articles. Belgium and France also consume it extensively.

IMPORTATION OF SEED.

Attempts to obtain seed for experiment by this Department, both from Spain and the seedsmen of Paris, have several times proved abortive. At last a small quantity has been obtained, and will be tested, with the hope of propagating the plant successfully, and introducing it among the light hill lands and on the mountain slopes of the South. It was obtained of Messrs. Vilmorin, Andreux & Co., of Paris, who thus refer to the difficulty of obtaining it:

As we told you in our former letter, seed of this plant is not in commerce. Many times we tried to procure it both in Spain and in Algeria, but always were informed that it does not yield fertile seed, and was propagated only by division of the old plant, some way similar to the propagation of sugar-cane, and it is by a mere chance that we have got the seed we have forwarded to you. A friend of ours, when in Spain some ten or twelve years ago, cut some of the flower-stems of the esparto grass, and on his return to France tried to sow the seeds he found in these specimens, and a very few did grow. He cultivated carefully the young plants, but all the seed he could collect remained sterile; he at last tried artificial fecundation, and succeeded this year to a certain extent. In continuing the experiment, he has been able to collect the seeds we have got this year.

THE NIIN OF YUCATAN.

A communication from Dr. Arthur Schott, late of the scientific commission of Yucatan, furnishes some descriptive statements concerning an insect, and the nature and uses of a grease-like or wax-like product, with the result of a chemical examination of its properties. It is assumed to be allied to the *Coccus cochinillifer*, or cochineal insect, yielding the well-known dye bearing that name; but no specimens have yet been received in the Department for examination and identification, and therefore its real place in the classification of the insect kingdom cannot be vouched for. As one of the natural productions of America, which may possibly attain some commercial importance as well as economic value in the arts, it is worthy of further examination. The following is, in substance, the letter of Dr. Schott:

Among the numerous interesting natural productions of Yucatan, not the least remarkable is the niin, (pronounced *neen*,) the knowledge of which, and of its technical application, has survived the national independence of the gifted Maya race. The niin is the grease of an insect bearing the same generic name. Though heretofore not entirely unknown to their Spanish rulers in Yucatan, the obtaining of the raw material, as well as its uses for domestic and technical purposes, has remained almost exclusively in the hands of the descendants of the Mayas. The niin may be considered akin to the cochineal, also the product of a similar insect; but they differ essentially in their nature, one serving as a well-known dye, while the other finds its application as a drying oil.

The nature of the niin will be clearly understood by the annexed scientific analysis, made and communicated by Mr. V. G. Bloede, analytical chemist, of New York. The matter examined by that gentleman consisted of a small quantity which Dr. Schott brought some time before from the city of Merida, Yucatan, where it was furnished him by the kindness of Señor Don Jose Hont, a druggist and extensive land proprietor of that rich peninsula. Mr. Bloede's report of his analysis is as follows:

The Yucatan niin is a yellowish-brown, fatty mass, having a peculiar oily odor. In its general properties it seems closely allied to hog's lard or suet. It is neutral to test-paper, neither presenting acid nor alkaline reaction, though when exposed to the air it acquires a very faint tendency to manifest the former. Its melting point is about 120° Fahrenheit, though, when once melted, it still remains in a semi-fluid state with the temperature as low as 80° or 85° Fahrenheit. When cooled to 10° Fahrenheit, it becomes hard and brittle, like suet. At ordinary temperature, that is, about 60° Fahrenheit, it is of a thick, pasty consistency, like ordinary lard. Its specific gravity at 60° Fahrenheit is about .92.

Its solvents.—In regard to solvents, the niin presents the same general properties as any ordinary animal fat. It is not soluble in either hot or cold alcohol, even after extended maceration. It is freely soluble in both hot and cold ether, with which it forms a yellow, oily liquid. It is very soluble in turpentine, with which it forms an oily liquid possessing peculiarly valuable properties for mixing delicate oil colors, of which I shall speak hereafter. It dissolves freely in benzine; chloroform, also, is among its best solvents.

Chemical properties.—The niin, in its classification in organic chemistry, must undoubtedly be ranked among the drying oils, though its absorption of oxygen takes place rather more slowly than with many other oils. Nor is this slowness in drying accelerated to any extent by boiling it with oxide of lead. It is the first, or nearly the first, example we have of a thoroughly drying animal butter or solid fat. Like some others

of the animal fats, it contains a distinct volatile acid peculiar to itself. As, for instance, butter contains butyric and caproic acid; goat's fat hircic acid; so the niin contains an acid of a peculiar, pungent smell, which might be aptly termed niinic acid. Its chemical composition differs little from ordinary animal fats. Like others, it contains a fluid oil—oleine—and a solid containing stearic, margaric, and other fatty acids. A portion of the acids may be obtained by dissolving the niin in turpentine or ether. The oily portions pass into solution, while a solid precipitates, consisting of the acids indicated, which may be separated from the fluid by filtration.

Saponification.—A peculiarity of the niin seems to be its difficult saponification. The strongest ammonia procurable has no saponifying action on it. Even if the fat be digested in ammonia for several days, no liniment is formed, but a marked transition from yellow to red seems to be the only change produced. This change of color depends merely on the action of ammonia on the coloring matter of the niin, which, like the yellow turmeric, (*Curcuma longa*,) changes to red as it assumes an alkaline reaction.

With potash, too, it saponifies but slowly and imperfectly, and a concentrated lye is necessary. With soda it forms a soap only after extended boiling with a strong lye. It is only after several hours' boiling with oxide of lead that it forms the so-called "lead soap," and then the product is very imperfect. From these facts we can at once deduce that the niin cannot be considered a "good saponifying fat," but belongs to the "drying oils."

Effects of high heat.—When the niin is melted in a porcelain dish, and the resulting oil exposed to continued and high heat (between 250° and 350° Fahrenheit) for an hour, or until a considerable portion of it has evaporated, the residue in the dish will then be found to have assumed a tough, flexible, varnish-like condition—a gelatinous mass no longer soluble in turpentine, or affected by heat or cold, at least to a great extent.

If a piece of this gelatinized niin is placed on a piece of porcelain, moistened with turpentine, and ignited, another remarkable change takes place; for, if the plate is slightly inclined as the mass burns, a thick yellow resinous oil or gum flows from it, which possesses most remarkable adhesiveness, closely resembling a thick solution of India-rubber, but which does not dry, retaining its half-fluid consistency for several days. This is a most singular change, and one that is worthy of further investigation.

Change of air.—When the turpentine solution of the niin is exposed to the air in thin stratas for a few days it acquires the properties of a resinous varnish; in fact, the change is so complete that when some of the solution is poured on a piece of glass it dries almost equal to fine shellac varnish. This change is due to the absorption of oxygen. If further developed, this property will undoubtedly make the niin of the greatest commercial value. The film of varnish is very elastic, and at the same time hard, which renders it superior to some of the other gums. An alcoholic solution can also be formed, but this is more difficult.

Suggestions as to use.—The extreme oiliness of the niin will undoubtedly make it very valuable for various purposes in the arts; and its "drying" solution in turpentine has no equal for mixing fine colors for artists. This turpentine solution of the niin produces a remarkable brightness in the colors prepared with it, and they dry rapidly. But the chief value of the niin, which will give it commercial importance, is its property of forming a resinous varnish when treated as before described, rendering it superior to shellac for some purposes. Another valuable application of the niin could be found in the manufacture of water-proof fabrics. A piece of the most porous Swedish filtering paper, saturated with a solution of the niin diluted in turpentine, will not allow a drop of water to pass through, even after standing in it for days. An excellent way of water-proofing would be to saturate the article with melted niin, and then expose it in an oven to considerable heat until the grease gelatinizes. By these means the niin becomes insoluble not only in water, but also in most of its solvents. If the niin can be obtained, as Dr. Schott says, in "unlimited" quantities, it will, doubtless, in time become of great commercial value.

I have given here but a few of the most important facts developed by my experiments: but I believe there would be hundreds of other applications suggested, if the general properties of the substance were made known. With hopes that the niin will prove of value, both in art and science,

I remain yours, &c.,

VICTOR G. BLOEDE, *Analytical Chemist.*

BROOKLYN, *January* 4, 1868.

The Maya word niin applies not solely to the grease above referred to, but also to the insect from which it is obtained. As far as observations go, the latter entomologically belongs to the lower species of *Hemiptera*, genus *Coccus*, where we find it associated with the well-known cochineal, (*Coccus cochinillifer*,) and also with the South Asiatic *Coccus lacca*.

With this it seems to have still closer affinities, for this lac insect principally lives on an euphorbiaceous plant, (*Aleurites laccifera*, or *triloba*,) and also on the banyan tree, (*Ficus Indica*,) upon which it produces the gum lacca of commerce. The life of the niin, on the other hand, seems to be exclusively wedded to the anacardiaceous genus, *Spondias*, (which embraces the mango fruit tree, the hog plum of the West Indies, &c.) of which one or two species are extensively cultivated all over the tropical regions of this continent, and the adjacent archipelago of the West Indies. Thus both insects, the one of Asia and the other of America, besides producing somewhat similar articles of commerce, offer in common the advantage of living on plants which are otherwise useful, and cultivated for the sake of their fruits; a circumstance which invites more readily the propagation of an almost unlimited number of these respective foster plants. The cultivation of the *Spondias*, called by the Spanish *ciruelo*, and by the Mayas *abal*, and probably referable to the species *Mombin*, is by nature made so easy that even thick cuttings germinate quickly in almost any soil. The gum, exuding spontaneously from the stem and branches of the *ciruelo*, is often used in Yucatan as an equivalent for gum arabic, while, by the instrumentality of the niin insect, (*i. e.*, by animalization,) it becomes a resinous drying oil, insoluable in water or alcohol, hot or cold.

The gathering of the niin insect and obtaining its grease presents no difficulty whatever, as children even can be intrusted with it. The grease is obtained by broiling or boiling the insects, during which process it can be readily taken off. Dr. S. says:

"My acquaintance with the niin insect having been but cursory, does not permit me to give a scientific description of it. No winged specimens have come under my notice, and I suppose, therefore, that only females were observed. These are about one inch long, with a cross diameter of about one-fourth of an inch. Their color varies from a somewhat pellucid chrome yellow to rich orange, though subdued by a closely adhering coat of fine, silky, white web, in which they are thickly enshrouded, and which appears to serve as a soft protecting cocoon, much like that of the cochineal insect. The aspect of a niin colony on the twigs and branch tops of the *ciruelo* has, therefore, much similarity to that which I have often observed of certain species of *opuntia* (prickly pear) on which cochineal insects were living. The plants, especially their upper parts, look as if covered by a heavy deposit of mildew.

"The principal crop of the niin insect falls in the rainy season, *i. e.*, between the months of April and September, during which time its principal growth and development are derived from the foster-plant.

"As to the uses for which the niin grease might be employed in art and science a wide field for speculation may be opened, as Mr. Bloede, in his analysis, has already indicated. The Indians and Mestizos of the peninsula, especially the inhabitants of one or two villages in the vicinity of Yzmel, have heretofore almost exclusively used it to mix the paints employed in adorning small articles of household use, such as bowls and drinking-cups made from the halves of the globular fruit of the calabash tree, (*Crescentia cujete*,) and in preparing a varnish for those and other articles. This use of the niin grease, however, seems not to be confined alone to Yucatan, but is met with in other parts of tropical America. I was told that the Indians and half-breed population in the vicinity of Vera Cruz excel the Mayas in the skill and taste they exhibit in the use of this article in adorning drinking-cups and other trinkets, both inside and out. From these modest articles of Indian finery it would be a

short step only to the manufacture of crockery, made of papier mâché, similar to the admirable tea-cups, bowls, and other dishes of the Japanese, employing the niin varnish, which endures for any length of time the effects of hot or cold water and of alcohol, to give a protecting and pre serving finish and beauty.

"Besides the uses of the niin already mentioned, it is also kept as a drug in the apothecary shops of Yucatan, where it is held for surgical purposes and general external use instead of other drying oils, like that of linseed for preparing vulnerary plasters and cerates in general.

"There is hardly room for doubt that the niin could be procured in sufficient quantity for commercial demands. The breeding of the insect producing the article depends entirely on the multiplication of a fruit tree which is already under extensive cultivation all over the tropics of this continent and adjacent islands; localities the greater part of which is easily accessible to maritime commerce. Within the space of a few years a steady enterprise would establish a fixed market price for the niin, so that women and children, and in fact the whole population, would contribute in the collection of the insect or the oil itself, as soon as they could rely upon a just exchangeable return for their labor."

STATISTICS OF BEE-KEEPING.

The business of bee-keeping has always been deemed an interesting and profitable branch of rural effort; it is even assuming national importance as a contribution to the food supply of an increasing population. It is also eminently worthy of fostering attention, as a means of agreeable, healthy, and profitable employment for women dependent upon their own exertions for a living, or ambitious of a business career suited to their tastes and to their physical strength. To ascertain the condition of bee-keeping, to learn of its progress, and collect at least fragmentary statistics of the business, the following inquiries were made of bee-keepers in all parts of the country:

QUESTIONS.

1. How many hives of bees are there in your county?
2. Did your stock originate from native wild bees, or from swarms introduced from other sections?
3. Have Italian bees been introduced into your county?
4. Are Italian bees found to be more docile, or more productive, than other bees?
5. Of what form and material are your hives: movable frames, common boxes, straw, or "gums"?
6. If patented, whose patent is preferred?
7. What is the average product in honey and wax, and the average price per pound, one season with another?
8. Were swarms abundant as usual last spring?
9. From what plants do your bees procure their food in spring, in summer, in autumn? and is any crop grown mainly for the use of bees?
10. Is the disease called *foul brood* prevalent among your bees? If so, has any remedy or preventive been found?
11. Are your bees usually wintered on their summer stands? If so, what means of protection are adopted?
12. Please give instances showing pecuniary returns, cost, and net profit of bee-keeping.

In 1850, the amount of honey and wax reported in the census returns was 14,853,790 pounds; in 1860, 23,366,357 pounds of honey, and 1,322,787 pounds of wax. New York stood at the head of the list, with 2,369,751 pounds; and nine other States are credited with more than a million pounds each, in the following order: North Carolina, 2,055,969; Kentucky, 1,768,692; Missouri, 1,585,983; Tennessee, 1,519,390; Ohio, 1,459,601; Virginia, 1,431,591; Pennsylvania, 1,402,128; Illinois, 1,346,803; Indiana, 1,224,489.

The statistical census of 1860 returned, from Massachusetts, 59,125 pounds of honey; the State census of 1865 gave 80,356 pounds, valued at $23,224—about 29 cents per pound.

The census of 1860 gives Iowa 917,877 pounds; the local returns of 1865 made an aggregate of 1,128,399 pounds, from 87,118 hives of bees. This gives an average of surplus honey to each hive of about thirteen pounds.

The circulars were sent to known apiarians in nearly every State, and returns were received from four hundred and eighty-nine counties, in

thirty-two States. The aggregate number of hives reported was 722,385. At the same ratio for the unreported counties, the aggregate for the country would be nearly three millions of hives. But reports have undoubtedly come from counties having somewhat more than any average population, including many in which special attention has been paid to bee culture; and a careful estimate should therefore place the total number of hives at a lower figure. Two millions would be as low as these returns appear to warrant. This is but one to every twenty of the present total population, while the assessors' returns of Iowa—the only official statement for comparison—present a ratio of one hive to ten of the population.

Estimating the total number of hives at two millions, and the surplus honey taken at only fifteen pounds per hive, (which is but two-thirds of the average reported,) the value of honey annually produced in the United States, at the average valuation of twenty-five cents per pound, would be $7,500,000. Were a rational system of bee-keeping in use, crops cultivated for bee pasturage, and the bees carefully wintered, this amount could easily be increased. The profits arising from the sale of surplus honey averages from fifty to two hundred per cent. of the capital invested. The middle, northern, and southern States are particularly adapted to profitable bee-keeping.

The following table presents in detail some of the more important points furnished in these returns:

States.	Number of counties reported.	Number of hives.	Number of counties reporting Italian swarms.	Product.		
				Honey.		
				Pounds per hive.	Price per pound.	Wax, price.
					Cts.	Cts.
Alabama	9	18,100	1 county.	21	17	25.7
Arkansas	6	4,100	No.	23	15.6	22.6
Connecticut	4	3,900	Yes.	50	38.7	60
Delaware	1	1,500		5	35	......
Florida	5	3,800		23.5	17	31.3
Georgia	22	13,215		23	17	20
Illinois	33	53,025	12 counties.	25.8	25	30
Iowa	27	29,144	16 counties.	35.8	23	......
Indiana	31	34,255	11 counties.	20	22	32
Kansas	3	1,530	2 counties.	41	30	40
Kentucky	24	31,050	2 counties.	25.6	21	30.5
Louisiana	5	7,100	1 parish.	21	27.6	......
Maryland	7	7,800	3 counties.	25.3	24.6	33.3
Massachusetts	7	9,040	7 counties.	27.6	29.8	48
Michigan	18	24,441	9 counties.	30.9	23	28
Minnesota	11	11,300	6 counties.	28	27	36
Mississippi	12	14,950		19.1	14.8	21
Missouri	42	36,925	10 counties.	24.3	21.3	21.3
New Hampshire	5	5,150	3 counties.	17	29.6	40
New Jersey	4	3,870	2 counties.	43.3	29.5	......
New York	14	61,328	8 counties.	21.8	20.5	32
North Carolina	34	77,553	1 county.	16	17.6	26.4
Ohio	32	81,475	23 counties.	16.9	24.7	30
Pennsylvania	25	62,690	15 counties.	22	30	34
Rhode Island	1	800		10	39	......
South Carolina	2	5,500		18.8	18.8	25
Tennessee	23	27,600	2 counties.	26.5	19.5	31.5
Texas	18	22,240	2 counties.	44.3	31	21.8
Vermont	8	15,140	7 counties.	21.5	26.2	39
Virginia	18	17,900	2 counties.	22	22	45
West Virginia	12	14,100	3 counties.	23	20	28
Wisconsin	26	32,864	18 counties.	26.8	26	33.5
				22.8	20.5	30

The reports show that in the southern States, where bee-keeping is in its primitive state, it would yield, if properly conducted, the largest return. The abundance of wild plants yielding honey, the long seasons, and mild climate there are all very favorable to profitable bee-keeping.

The chief expense of an apiary in starting is the cost of the hives. When these are procured they form a permanent capital; the hive will last for years. Bee-keeping will be found profitable only to those who engage in it largely, but both profitable and interesting to any person having room sufficient even for one hive. He can supply his table all the year with honey, and find in the nature and workings of these little insects subjects for most interesting study and critical investigation.

HIVES.

The common box hive is the one most generally used. It is usually made of one-and-a-half-inch pine boards, though other materials are used, according to the taste of the maker or the cost of the material. The size of the hive varies much, but generally contains two hundred cubic inches, with cross-bars placed in the center to aid in supporting the combs. In general, they are simple boxes. This form is varied at times, however, by placing on the top of the hive drawers or boxes for surplus honey. In these hives the bees are left to take care of themselves, as very little can be done to aid them. The old-fashioned basket or straw hive is seldom used, and it will soon be wholly discarded, save by a few bee-keepers, who may retain it rather as a curiosity than for any practical use.

In the southern States the favorite form of hive is the "gum." This consists of a hollow log, generally a portion of a cypress stump, about two feet in length and a foot in diameter; upon the top of the hollow is placed a board, and at the bottom is cut a small notch for the entrance of the bees, and the hive is complete. Three-fourths of the hives in these States are of this description. This form of hive served the purpose before the appearance of the moth and foul-brood, but no reliance can now be placed upon it. If the moth is gaining the upper hand, foul-brood raging, honey supply low, or queen lost, there is no remedy—the bees must perish. The do-nothing system in bee-keeping, as in other branches of agriculture, will lead to the ruin of the bee-keeper. Those apiarians who use the movable-comb hive and a scientific method of bee-keeping have been the most successful.

The reports show that the movable-comb hive of the Rev. L. L. Langstroth is generally preferred by the bee-keepers of the United States. The Bee-keepers' Association of Tennessee, at their recent convention, by a unanimous vote gave this hive the preference over all other forms. Patent hives have been the curse of bee-keeping in this country. Many of the reports say that the bee-keepers in their vicinity have abandoned all manner and style of patent hives and gone back to the plain box and rude "gum."

Patent bee-palaces, moth-traps, and self-dividers have done as much as the bee-moth, perhaps more, to hinder the progress of bee-culture in this country. That hive only can claim superiority over the common box which permits the bee-keeper to have ready access to every portion of the hive, allows the transfer of frames from one hive to another, will winter bees well, is not complicated in its structure, and is not expensive.

The movable-comb hive is used by about one-fourth of the bee-keepers of the country, and its introduction is rapidly extending. Whenever its use becomes general, bee-keeping will become profitable.

HONEY.

The returns of the yield of honey are very imperfect, as few bee-keepers have kept an account of the yield of their hives. The product of the past season has been less than usual. The late spring and frost, and the scorching heat of the summer, ruined the forage of the bees, and many colonies were unable to obtain honey sufficient for their winter supply, and, unless fed during the winter, will perish. This has been the case principally with the black bees. The Italians, notwithstanding the unfavorable season, were able to gather a supply of honey sufficient for themselves and to yield their owners a small surplus. The average yield of honey throughout the United States is 22.8 pounds per hive. The average price is twenty to twenty-five cents per pound. Honey for market purposes is generally stored in small boxes or supers, about five inches square. This brings the highest market price. The honeycomb taken from the common box hive or "gum" is necessarily in a broken condition, and does not present to the purchaser so clean and inviting an appearance, and hence commands a lower price.

Twenty pounds of honey being required to make one pound of wax, the economy of saving and utilizing combs is rendered evident. In order to accomplish this saving, a honey-emptying machine has been invented, and has now been so simplified in its construction that it is within the reach of all. By this machine honey is emptied, by centrifugal motion, out of the combs, leaving them in a sound condition, so that they may be inserted again, and used for years in succession, thus effecting a great saving in the consumption of honey, and giving the market a purer article than when rendered by heat.

The reports upon the production of wax are still more imperfect than those on honey. The yield is principally derived from hives that are "brimstoned" in the fall, or from old combs that are unfit for use. The demand for wax is always greater than the supply, especially in regard to bleached wax, and it always commands a good price. Little or no attention has been given to this branch of agriculture.

The provident economy of the German makes this apparently trivial item yield a good return. The German apiarian never goes to his hives without having by him a small box or dish in which he carefully deposits every particle of wax, however small, which may be taken from the hives, and also all the droppings. Thus, at the end of the season, a considerable amount of wax has been saved, which in this country is not only wasted but permitted to lie about the apiary and become the breeding place of moths and a source of foul-brood. The bee-keepers of America should profit by this hint, and avert injury and loss. The average price is thirty cents per pound.

WINTERING BEES.

Nine-tenths of the bee-keepers of the United States pay no attention whatever to wintering their bees. The hives are permitted to remain on their summer stands, with the exception, perhaps, of a slight shed for a covering. They are thus exposed to all the variations of temperature and the inclemency of the weather. The result of this neglect is that many hives perish annually, and those that survive are so weakened that they are unable to recruit till the honey season is passed.

To make bee-hiving successful, it is necessary to have strong swarms early in spring. This result can be obtained only by careful and judicious wintering. The object sought in wintering bees is to maintain in

the hive throughout the winter a uniform temperature, which will keep the bees in a continuous semi-dormant state. This uniformity of temperature is obtained in several different ways—by protecting the hives on their summer stands, or by removing them to rooms or places prepared for them. Hives may be protected on their summer stands—

First. By plastering up all the cracks and openings, except the entrance, with mortar and surrounding the sides of the hives with straw. This can be done only with common boxes or gums.

Second. By placing the hives in a shed, closed on all sides except the front, where the covering extends to within three feet of the ground. A correspondent in Pennsylvania states that he has wintered successfully in this manner one hundred colonies.

Third. By surrounding the hive with a dead-air space, thus preventing outside influence. A frame of light boards is made to surmount the hive on its four sides, leaving an inch or more space between the hive and frame, which space is filled with some good non-conducting material, as sawdust, dry leaves, &c. The honey-board is removed and straw or corn-cobs placed on the combs beneath the cap. This plan has been successfully adopted by a number of bee-keepers.

Some apiarians winter their bees with considerable success on their summer stands, by simply giving them thorough ventilation. Mr. John T. Rose, of Petersburg, Monroe county, Michigan, says in regard to this method: "I winter them on their summer stands, and seldom lose a swarm. I bore in the side of the frame hive an inch hole, three inches from the top, in the middle of the hive lengthwise, and worm an inch-square stick through the combs for winter passages: make a frame the size of my hive, three inches deep, without top or bottom, remove the honey-board, and set the frame on the top of the hive, and fill it with dry corn-cobs: put on the cap, and they are safe."

The plan which has proved most successful and economical is that of wintering bees in a room or cellar prepared for the purpose. The apartment must be dark, dry, and of a low uniform temperature, not falling below 32° and never exceeding 40° Fahrenheit. Bees thus located consume one-third less honey and come out in the spring strong and healthy. Care must be taken to give the hive placed in cellars proper ventilation; otherwise the most disastrous results will ensue, the bees becoming restless, consuming honey, and leaving the hives, and thus perishing in the room. Mr. R. Dart, of Wisconsin, says: "My bees are wintered in a dry cellar, thirty-two by thirty-six feet, holding one hundred swarms. I carry them into the cellar the first of December and bring them out during the month of March, on warm, sunny days. I pack them closely on benches in the cellar, leaving the box and working-holes open, and see that all the swarms have honey enough to support them until taken back to their summer stands. I visit them but once a month, and see that they are not disturbed. When breeding commences, the last of February, I change the air in the cellar every night. By this management I do not lose a single swarm through the winter. Many of my swarms did not consume six pounds of honey while in the cellar last winter." Bees wintered on their summer stands will consume through the winter thirty pounds of honey, while those wintered in cellars will consume but little over six pounds per hive, thus effecting a saving of twenty-four pounds to the hive, giving, in an apiary of one hundred colonies, 2,400 pounds of honey, which, at twenty cents per pound, would amount to $480, a sum sufficient to pay for the building.

North of forty degrees of latitude it is necessary to give winter protection, if bees are to be kept with profit. The cellar or root-house can

generally be used for storing the colonies. Henry C. Blynn, Columbia County, New York, states that he is building a wintering house, with triple walls all around, filled with straw and sawdust, the whole two feet thick, and then clapboarded on the outside of the studding. The greatest attention is paid to wintering bees in Wisconsin, Michigan, and Minnesota, where they could not be kept without protection, except at continual loss. It is to be hoped that the bee-keepers will begin to pay more attention to this important subject. It would annually effect a saving of thousands of pounds of honey.

In the South the winters are so mild that the bees need little or no protection during that season. They need, however, protection in the summer from the hot rays of the sun. This is accomplished by placing the hives under sheds or large trees. The greatest attention should also be given to ventilation, in order to prevent the heat from melting the combs.

Rev. J. V. Allison, of Ogle County, Illinois, writing in reference to burying bees, says: "This season a neighbor, who keeps no bees, told me that, when living with his father, some twenty years since, he and his brothers were going to take up a stock late in the fall; as an experiment, they drummed the bees out into an empty hive, and with them clustered in the top, buried the hive in the ground so deep that there were six inches of dirt over the top of it, and they left it thus buried till the following April. When brought out of their winter quarters the bees, he said, were alive, and, after warming up, flew freely: but having nothing to eat, and not being fed, they died in the course of three days." Can this be true? We give it as a singular case.

FOUL-BROOD.

The returns show that this contagious disease is not extensively prevalent in the United States. It has, however, made its appearance in various portions of many States: in Floyd County, Georgia; Fayette and Hancock Counties, Illinois; Anne Arundel County, Maryland; Winona and Wright Counties, Minnesota; Clark County, Missouri; Iredell, Caldwell, Columbia, Currituck, and Herford Counties, North Carolina; New York, Schenectady, and Montgomery Counties, New York; Cumberland, Jefferson, Luzerne, Washington, and Warren Counties, Pennsylvania; Richland County, South Carolina; Milwaukee and Walworth Counties, and Sullivan Township, Wisconsin; and Hartford County, Connecticut.

Putrid foul-brood is a disease which attacks the young brood of the hive, showing itself fully after the larvæ have been sealed up. It may be known by the viscous, gelatinous, and yeast-like appearance of the decomposing brood, the unpleasant odor arising from the hive, and by the sunken covers of the cells. The cause of foul-brood has been, until recently, involved in doubt, but late discoveries in Germany have thrown much light upon its origin. Mr. Lamprecht alleges that he has discovered the cause of the disease. His theory is this: "The chyme, which the workers prepare from honey and pollen by partial digestion, and with which the larvæ are fed, contains a *nitrogenous, plastic, formative substance, from which all the organs and tissues of the larvæ are derived and composed* * * ; and precisely because of this its complicated composition it is peculiarly susceptible of rapid decomposition when exposed to air and moisture; that is, to undergo fermentation and putrefaction. It is hence obvious that pollen, even though having undergone only a partial decomposition, must affect the bodies of bees and larvæ

differently from what it did or would do in its natural condition; and there is no longer a doubt that it is *from pollen, thus partially decomposed, that the foul-brood originates.* That it can readily undergo decomposition is manifest. Moisture, emanating in part from unsealed honey, and in part from the perspiration of the bees, becomes condensed in the hive from external cold, and in the fall and toward spring it is frequently found hanging in drops on the combs, just as we find it condensed on the windows of our dwelling-houses. If one of these drops falls into a cell containing pollen, decomposition of the latter speedily commences, and is then communicated by the bees to the pollen in the other cells; and the cause of foul-brood is hence abundantly present in a hive thus circumstanced."

The discovery of Dr. Preuss, an eminent physician and mycologist, is that a microscopic fungus, *Cryptococcus alvearis*, developed from fermenting matter, feeds upon the young larvæ, and thus causes foul-brood; and that by means of the numerous sporules of the fungus, the disease is spread through the hive, and finally through the apiary. To show the character of this microscopic pest we quote the following from the article of Dr. Preuss, published in the Bienenzeitung, and translated by Mr. T. W. Woodbury:

"The foul-brood fungus, which I have named *Cryptococcus alvearis*, belongs to the smallest of the fungoid forms. It is round and dust-shaped, and has a diameter of $\frac{1}{500}$ millimeter, or $\frac{1}{1095}$ line; consequently 1,095 can lie side by side within a Rhenish line, but within a square line, 1,095×1,095, that is, 1,199,825, or, in round numbers, 1,200,000. The cubic line, according to this, would contain 1,440,000,000,000 fungi, and a cubic inch of foul-brood, which consists of 1728 lines, would contain 2,488,320,000,000,000. If we reckon, further, that a cubic inch of comb contains 50 cells, the contents of each would be 49,766,400,000,000; in round numbers, fifty billions; or, deducting one-fifth for wax, forty billions of fungi."

There is no cure for this disease when it has once obtained headway. Destruction of the bees and honey and thorough purification of the hive is the only remedy to prevent the spread of the disease. As a means of preventing the disease, Dr. Preuss gives the following directions: Feed no fermenting honey; feed no meal, especially when the hive is threatened with disease; destroy carefully every particle of dead and moldering matter; and avoid weakening bees during the brooding seasons, so that they will not be able properly to maintain the heat necessary for the development of the brood.

With the light now thrown upon the nature of this disease by these recent discoveries, bee-keepers may be able to conquer the contagious malady whenever it makes its appearance.

THE DISEASE OF 1868.

During the past season a disease suddenly appeared in Indiana, Kentucky, and Tennessee, sweeping away whole apiaries. So quiet were its operations that the bee-keepers became aware of its existence only by the disappearance of their bees. The hives were left, in most cases, full of honey, but with no brood and little pollen; the whole appearance of the hive causing the casual observer to suppose that the bees had "emigrated;" but close observation showed that they had died. We give a number of accounts from various correspondents, principally from Indiana and Kentucky, where this disease first raged.

Jesse R. Newson, Bartholomew County, Indiana, says: "With an

experience of twenty-five years, I have not seen so disastrous results among bees as in the present year. We generally feel that all is well with our bees, if they have succeeded well in laying up a winter supply of food. I have lost nineteen stands since the first of November; in some of them as many as forty pounds of honey were left, looking very nice, and tasting as well as any I ever saw; no sign of moth or anything wrong that I could see. The bees seem to die without a cause. The stand twenty years old is yet living. We find in nearly every stand plenty of food, but what ails the bees? What the remedy? If something is not done to stop this fatality, this pleasing and useful pastime will be taken from us, and our tables will be robbed of honey."

A. Leslie, Pike County, Indiana, says: "Nearly all our bees have died in this county, perishing mostly in November, supposed to be for want of bee-bread."

S. G. Bates, Boone County, says: "The mortality among the bees this winter cannot be accounted for, since they have plenty of food. Out of twelve hives I this day took three hundred pounds of honey; not a young bee to be found; the comb clear and healthy. My opinion is, that the queen, from some reason, not having deposited eggs, is the cause of their death."

T. J. Connett, of Austin, Scott County, Indiana, says: "There is a disease prevailing to an alarming extent among our bees this fall that is entirely new, nobody being able to find any cause or remedy. Old and substantial swarms die, leaving the hive full of honey and bee-bread. Full three-fourths of the swarms are dead, as far as I have heard from them."

J. N. Webb, Newcastle, Henry County, Kentucky, says: "There were no swarms last spring, so far as is known. The bees, however, continued to work and lay up their stores until some time in August, or early in September, when, to the consternation and utter surprise of the bee-raiser, they were all found to have died. Many swarms left well-stored stands of excellent honey, amply sufficient to carry them through the winter; and what is more strange, comparatively few of the bees were found dead at the hives. What was the cause of the wholesale destruction of this useful and interesting insect, dying in the midst of plenty, away from its hive, we cannot understand. Up to the time when the discovery was made, no frosts had come, no atmospheric change had taken place, out of the ordinary course, and in fact nothing to which it may have been rationally attributed."

T. Hullman, jr., of Terre Haute, Indiana, writes as follows: "In September last, when the first cold weather set in, my bees began to die. First, I found in one of my best stands, with all the frames full of sealed honey, and some honey in boxes, the bees all dead. After that the bees began to die in all my stands, mostly pure Italians, and some hybrids. First, about one-third of the bees would be found dead; next, I would find the queen lying dead before the hive; and in about a week more, the whole colony would be found dead in and around the hive. Sometimes the queen would live with a handful of bees. The hives were full of honey, gathered the latter part of the season; and the smallest had enough for the bees to winter upon. In this way I have lost forty stands, and have now only fifteen skeleton colonies, which I think will also perish before spring. At first I thought I was the only victim, but I have ascertained that all the bees in this neighborhood have died, and as far as thirty miles north and eighteen south. Yesterday I saw a letter from Kentucky, from a man who thought his bees had stampeded in the same manner as mine, to the hive of mother-earth. Some colonies had broods,

others had not. Late in October all the queens commenced laying again. To some colonies I gave three queens in about two weeks, and they lost each in turn."

The true cause of the disease has not been discovered. Some attribute it to the want of pollen; some to poisonous honey; and some to the unusually hot summer. Whatever may be the cause, the effect has been most disastrous, throughout these two States.

BEE PASTURAGE.

Apiarians, to secure a good crop of honey, are beginning to raise crops for the pasturage of their bees. The rapid spread of improved agriculture has, in many localities, destroyed the wild honey-yielding plants, so that the profits of bee-keeping are made to depend upon the honey-producing qualities of cultivated plants. The three plants upon which the chief reliance is placed are buckwheat, mustard, and Alsike clover. Buckwheat is the crop most generally sown, though Alsike clover seems destined to supersede it in suitable soils. The advantages of the Alsike are that its honey is of a finer quality than that of buckwheat, and that it affords most excellent fodder, and fine fall pasturage for cattle. Mustard is raised to some extent, and yields a fair supply of honey.

J. King, of Dubuque, Iowa, states that he has grown with profit the purple cane raspberry. Mrs. Tupper, of Iowa, says she has sown Alsike clover, and "esteems it above all other plants." J. T. Rose, of Monroe County, Michigan, thinks the culture of Alsike clover should be greatly encouraged, as it is valuable for hay as well as for bees. He says that it does not kill out in winter, as does the red clover in his State.

J. R. Gardner, of Montgomery County, Virginia, says: "I sowed, in April, 1867, five pounds of Alsike or hybrid clover, used upon one acre of moderately rich land. Last spring it came forward rapidly and bloomed profusely about the time white clover came into bloom. My bees worked on it from early morn until evening, seeming to prefer it to the white clover. I cut the first crop for seed, but owing to the wet spring it did not yield much seed. The second growth was very rapid, and it again bloomed very full, giving the bees a fine pasturage until frost. I consider it a valuable plant for bee-pasturage, as by cutting it at the proper season it will make a fine show of bloom in the fall, after the clover is gone. It is also as valuable a hay crop as red clover, and will stand the winter better from having a fibrous root, which takes a strong hold in our clay soil. If the farmers in the county could be induced to sow this variety instead of red clover, bee-keeping, I am satisfied, could be made profitable by using properly constructed hives, and introducing the Italian variety of the bee into this country generally.

White clover, the linden-tree, the golden rod, and the aster are the main support of the honey-bee. White clover and the linden-tree yield the best honey, while that from the honey-dew is of an inferior quality.

Mr. R. Rogers, of Webster, North Carolina, accompanies his report with a specimen of a plant, of which he says: "There is a minute plant growing around me, that I have seen nowhere else, which keeps green all winter; and, at the beginning of the first open weather in February, covers the earth with a dense and beautiful carpet of green, bearing a great profusion of white bloom. Every warm day in early spring the bees from all the neighborhood literally swarm upon it, drinking the nectar from its tiny cups. I do not know its name or its botanic position."

Professor Porter, of Lafayette college, Pennsylvania, names this plant

Phacelia parviflora, Pursh. We hope bee-keepers will pay attention to plants upon which bees feed, and send specimens to the Department, in order that a complete list of honey and pollen yielding plants may be obtained.

The following list comprises some of the plants from which bees gather honey and pollen during the feeding seasons:

Spring.—Willow, alder, aspen or poplar, elm, maple, marsh-marigold. hepatica, anemone, dandelion, erythronium, *(albidum,)* service-berry, *(Amelanchier Canadensis,)* currant, gooseberry, strawberry, peach, cherry, apple, pear, China-tree, *(Melia Azedarach,)* black-gum, *(Nyssa multiflora,)* whortleberry, cottonwood, cornel or dogwood, narcissus, honeysuckle, oak, red-bud, *(Cercis Canadensis,)* hazle, yellow jasmine, *(Jasminum ordoratissimum,)* sweet-myrtle, *(Myrica gale.)* magnolia, *(glauca,)* hawthorn, box-elder, *(Negundo aceroides,)* locust. azalea.

Summer.—Red clover, white clover. raspberry, blackberry, cockspur. thorn, whortleberry, black-haw, *(Viburnum prunifolium.)* self-heal, *(Brunella,)* azalea. sour-wood, *(Oxydendrum arboreum,)* cinquefoil, cucumber, narrow-leaved plantain, horse-chestnut, strawberry, pea, honey-dew, (on live oak.) chincapin, *(Castanea pumila,)* persimmon, linden, bee-balm, *(Melissa officinalis,)* maize. sorghum, heliotrope, iron-weed, *(Vernonia,)* smart-weed. *(Polygonum Persicaria;)* butterfly-weed, *(Asclepias tuberosa,)* viper's bugloss, *(Echium vulgare,)* cotton plant, buckwheat, sumac, catnip, Spanish needles, *(Bidens bipinnata.)* beggar's lice, *(Cynoglossum Morisoni,)* boneset, starwort. *(Stellaria.)* silk-weed, *(Asclepias cornuti,)* thistle, sage. cardinal flower, balsam. mountain mint, *(Monarda didyma,)* sweet marjoram, lavender, spearmint, peppermint, thyme, dandelion. chickweed, pennyroyal, sweet clover, speedwell, *(Veronica,)* poppy, turnip, hollyhock, sunflower, dahlia, phlox.

Autumn.—Aster, golden-rod, dandelion, white clover, red clover, cinquefoil, chickweed, pennyroyal, artichoke, phlox, chrysanthemum.

SILK CULTURE.

That the culture of silk can be profitably carried on in the United States is clearly established. The success of the experiments in California has far surpassed the most sanguine expectations of those engaged in them. Mr. Prevost, the pioneer silk grower of that State, and formerly engaged in the same pursuit in France, maintains, after twelve years' experience, that California is "the best silk country in the world," and that the manufactured article, even in its best grades, can be produced cheaper than in Europe. At an early period silk was raised in Virginia. In 1718 experiments in Louisiana were successful, and a good article of silk was produced. For about forty years, silk of a superior quality was raised in Georgia, continuing to be the leading and most profitable product of the colony until it was prostrated by the revolutionary war. In most of the colonies, prior to the revolution, the culture of silk was more or less successful, in Georgia and South Carolina especially so. Cocoons of an excellent quality were produced in Pennsylvania, New Jersey, Massachusetts and Connecticut. In 1771 a silk establishment was started in Philadelphia for the manufacture of silk of native growth, which for a series of years received a large amount of cocoons. The culture and manufacture of this valuable commodity are still carried on in parts of New England, in New York, Pennsylvania and New Jersey. Philadelphia, Paterson, New Jersey, Hartford, Manchester, and Mansfield, Connecticut, are noted for their extensive silk manufactures. The manufactured silk product of the United States in 1840 was valued at $250,000. In 1844 it had increased to $1,500,000. In 1860 the product in New York, Pennsylvania, New Jersey, Massachusetts, and Connecticut was estimated at over $5,000,000; the leading article manufactured being sewing silk. Since that date the manufacture of silk in those States has been making steady progress, embracing a wide range of articles, as ribbons, braids, trimmings, fringes, and different varieties of dress goods.

It is a source of great encouragement that the diseases which threaten the total destruction of the native species of silk-worms in Europe do not prevail in this country. Mr. Prevost asserts that while from twenty-five to seventy-five per cent. of silk-worms are destroyed by disease and the unpropitious climate of Europe, few ever perish in California. The article from a California correspondent, published herewith, fully sets out the advantages possessed by that State over the silk-growing countries of Europe.

THE SILK INTEREST AT THE PARIS EXPOSITION.

The report of Hon. Elliott C. Cowdin, one of the commissioners representing the United States at the Paris Universal Exposition of 1867, and to whom was assigned the subject of silk and silk manufactures, contains much valuable information concerning the progress and present condition of silk husbandry and manufactures in foreign countries, and throws out many suggestions which cannot fail to be useful to those entering upon the culture or the transformation of silk in this country.

The progressive development of silk industry is carefully noted. In

1812 there were in seven of the principal towns of France 27,000 silk looms; in 1824 Lyons alone had nearly 25,000, and in 1839, 40,000. In the latter year there were 85,000 looms in the kingdom, employing about 170,000 workmen, and the production was estimated at $46,300,000. In 1850 the silk goods produced were estimated at $75,000,000; in 1855, at $106,500,000—the number of looms in the empire having increased to 225,000, and the number of workmen employed to half a million. In 1860 the product was estimated at $140,000,000. The United States purchased of French tissues alone, in 1859, $27,000,000; in 1860, $20,800,000; on account of the war of the rebellion, our purchases fell to $5,000,000 in 1861. The commissioner states, as the result of his observations, that though the rebellion has been suppressed, the fiscal measures resulting therefrom still have their effect upon the silk husbandry and manufacture of France, operating as they do at the same period with the scarcity of indigenous silk, and the prevalence of mysterious disease among the silk-worms.

The operations of England in silk are confined to manufactures of the raw material, her uncongenial climate not permitting the rearing of silk-worms. In 1823 Great Britain exported of silk goods $702,000; in 1844, $3,682,000; in 1856, $14,800,000; in 1858, $11,950,000; in 1861, $11,560,900; in 1865, $10,886,000. A recent treaty with France has seriously interfered with some branches of the silk industry of Great Britain. In view of the fact that the manufacturers of England are wholly dependent upon foreign importations of raw silk, it is well observed that an instructive lesson is taught the citizens of our country, where everything combines to render the prosecution of this industry pre-eminently successful.

The following table is given to show, as near as can be ascertained, the value of raw silk produced annually in the nations of the earth:

Chinese empire	$81,200,000
Japanese empire	17,000,000
Persia	5,000,000
Asia Minor	5,200,000
Syria	1,800,000
Turkistan (in China)	400,000
Turkistan (independent, in Asia)	1,400,000
Corean Archipelago	100,000
France	25,600,000
Italy	39,200,000
Turkey in Europe	7,000,000
Spain and Portugal	3,200,000
Pontifical States	1,300,000
Greece, Ionian islands	840,000
Morocco, Algeria, Tunis, Mediterranean coast	300,000
Basin of the Danube, Austria, Bavaria, Servia, Hungary	1,280,000
India	24,000,000
America	80,000
Total	214,900,000

BRANCHES OF SILK MANUFACTURE.

In silk industry there are seven distinct branches, or specialties: 1st, the rearing of the silk-worms; 2d, the filature or reeling of the silk from the cocoons; 3d, the throwing or spinning of the silk thread; 4th, the

dyeing of the silk; 5th, the preparation of the silk threads for the looms; 6th, the weaving of silk goods; 7th, the spinning of waste silk. Commissioner Cowdin reports the condition of, and progress made in, the branches severally, as manifested at the Paris Exposition.

In regard to the first, for purposes of reproduction it is important to choose cocoons of the largest size, and those the most successfully reared and least affected with any malady during the course of their development. These cocoons are recognized by the regularity of their form, the roundness of their extremities, the fineness of grain on the surface, and the solidity and thickness of the layers or silky envelopes. The male cocoons differ from the female in shape and size; the former being smaller, and presenting a cavity upon their back: the latter present the figure of an olive or the egg of a small bird. After collecting, the cocoons should be of a golden yellow color, and exhibit no spot or stain of any kind. After having put a certain number of male cocoons on one side, and of females on the other, weigh both parts to find the average weight of each, and every time this average is exceeded there is a presumption that excellent cocoons are obtained for reproduction, all other things being equal. Cocoons of an exceptional bulk are generally the result of two grubs united under the same envelope. Their product is known as "doubles," and is always inferior, being valued at hardly one-third the price of the normal product. An Italian silk husbandman exhibited at the Exposition an apparatus designed to prevent these doubles in the breeding of worms. It is an arrangement of cells made of light wood, each one having only the bulk necessary for a single grub. Each insect, therefore, at the proper time, has its own case, and doubles are rendered impossible. The inventor also claims that his system affords facilities for the choice of the best reproducers, and prevents coupling between grubs of the same family, consanguinity being by many considered as one cause of the rapid deterioration of the breed. The coupling accomplished, the females are removed and made to lay, each in her own cell, in such a way as to admit of the eggs of each laying being separately weighed. For good chances of success each laying should weigh at least sixty or seventy grams (per kilogram of cocoons,) each gram to contain thirteen hundred and fifty to fifteen hundred eggs.

The best known varieties of silk-worms are seven in number. The common silk-worm (*Bombyx mori*) is the species most in use, and produces the best silk: it feeds on the leaves of the mulberry tree, and attains its full growth in about six weeks. The castor-oil plant silk-worm (*Bombyx arrindia*) is a native of Bengal and British India, and lives on the food indicated by its name. It has been successfully propagated in Europe, where its silk product is found to be supple and durable, but almost destitute of luster. The ailanthus silk-worm (*Bombyx Cynthia*) is indigenous to the temperate regions of China. It produces an elongated cocoon, of a reddish shade, from which a strong and durable tissue is made. This worm was introduced in France in 1858, and its silk is growing in importance and industrial value. The Tusseh silk-worm (*Bombyx mylitta*) lives in a wild state in Bengal, and in the woods of the hot regions of India. Its food is the leaves of the jujube tree. Their cocoons produce a fine and brilliant silk. Every effort to reproduce this worm in France has failed. The wild silk-worm of Japan (*Bombyx Yama Mai*) has been successfully reared in France. The leaves of the oak and similar trees are its only food. It is easy to raise, and furnishes a cocoon of greenish yellow, and can be reeled into a beautiful silk. The *Bombyx Cecropia* is indigenous to the temperate regions of North America, and found principally in the Carolinas, Louisiana and

Virginia. Its food is the elm, the willow, and other trees. The cocoon is of loose texture and coarse silk.

THE MANUFACTURE OF SILK.

To transfer cocoons into the raw silk of commerce a basin and reel only are used; the former containing warm water to soften the gum of the envelope, so that the silken layers of the cocoon may be set free. In reeling, a certain number of threads of the cocoons, in proportion to the standard of raw silk intended to be produced, are united by pressure and twisting. This union of raw threads is known as *grége* or raw silk. Great care must be taken to prevent the threads, issuing wet and gummy from the basin, from adhering together; a sufficient distance between the basin and the reel, to permit a partial drying must be allowed, and a guide-thread be so arranged as to secure a zigzag movement, which prevents the threads from crossing one another. The following suggestions in regard to this branch of the work are given: The degree of previous preparation should vary with the durability of the silky couches, having regard to the age, breed, and origin of the cocoons. If prepared too much, the result would be that more silky matter would be yielded by the first layers than there should be. This superfluous matter would be only waste, and would possess a value much inferior to that of fine silk. If the cocoons are, on the contrary, insufficiently prepared, they present a resistance to the winding off, which causes the breaking of the thread, and leads to a new source of waste. The workmen ought to possess great skill in joining a new thread to thread in work. He should be competent to select the most opportune moment to assure the regularity of the product, so that the trace of these successive connections may be imperceptible to the eye, and thus avoid knots, coarseness, curls, or dots. Nor will rare skill in these particulars produce the effect desired unless the wheel revolves with a fixed and steady velocity of at least five hundred meters per minute. Without this, the thread, instead of being smooth and brilliant, would be rough and dull. A too slow movement would not dress the thread sufficiently, clasped as it is very tightly by its peculiar position, and fixed under the form of a figure 8 in the layers of the cocoon. A movement too slow causes those undulations which give the dull appearance; while the development of the thread in the straight line by the more rapid movement permits the reflection of the light in those perfect and determined conditions which give brilliancy to the finest silk.

At the Paris Exposition almost every European nation was represented by different mechanisms employed in the manufacture of silk. Mr. Cowdin is careful to name the uses, and particularly describe the best of these.

A very ingenious apparatus, invented by G. Honneger, of Switzerland, for the sorting of silk threads was exhibited. This machine receives on the one part a series of silk skeins, to each of which correspond a number of bobbins or reels, equal to that of the varied bulk, supposed to be contained in the skein. Each bobbin will receive the portion of the thread of the titre for which it shall have been designated. For this purpose, the thread which is rendered from the skein to the bobbins is guided automatically by a mechanism for gauging, extremely sensitive, and so arranged that the *grége* or raw silk in passing acts upon a lever which directs the silk upon the proper bobbin. The variation in the bulk of the product is the point of departure in the variation of the guide lever, which directs the thread to the reel proper to receive it.

By the employment of this machine, it is thought, the cheap silk of the East may find more extensive applications, and contribute to a new development in silk industry.

Professor Alcan exhibited an apparatus for testing the tenacity and elasticity of filaments and threads, and determining the degree of tension most suitable to be employed on any given thread. The instrument is described as one of rare precision, very simple, and not expensive.

The throwing of silk is intended to give a peculiar appearance to the threads, which partly determines what is called the grain of the stuff. It requires accurate knowledge and rare skill. The machines exhibited at the Exposition, used in this branch of silk industry, were those employed in the best factories, especially those of Switzerland. These consisted of, 1st, a series of *tavelles* to wind, clean, and equalize the threads during their automatic winding off; 2d, an apparatus to unite and double the threads, with a mechanism for instantly stopping the machine whenever a thread breaks; 3d, a machine to give the first twist to the double threads in the direction determined for the production of the tram or woof; 4th, a second machine to retwist together two threads already twisted separately, thus producing organzine. The object of these machines, which are simple in their construction, is to obtain constantly an evenly twisted product.

The attempt to unite in a single operation the winding off of cocoons and the throwing of silk has not been successful. Commissioner Cowdin refers to the mechanism exhibited by the Italians and French, and claimed as solutions of the problem, as possessing minor interest, and affording little encouragement. It is his opinion that the desired process, which is enticing in appearance as a great saving of time, labor, and money, is deceptive, demanding an expense much greater than that of the separate operations, and that it would yield inferior products of inconsiderable value. Simultaneous twisting and throwing, however, may be employed with a certain success when the cocoons are of an inferior quality and difficult to wind off, such as double cocoons, so that the operator in twisting them directly can, at the best, obtain silk of a very inferior grade, fit only for working common *cordonnet*, (braid, binding, twist, lace, &c.)

The "waste" occasioned by the various manipulations of silk until it becomes stuff, has long been utilized, and also, more recently, since silk became very high, the *chiffons*, or rags of that material. In the show-cases of the Exposition, France and Switzerland displayed threads made from waste, which rivaled in beauty of appearance the most lustrous silks, and at one-half the price. The result is obtained by attention to details in the manufacture. When the threads from waste have been produced with the greatest care, well purified, well combed, perfectly prepared and spun, a thin layer of warm gelatine or isinglass is applied to them when stretched and in motion. Sweepings of threads, formerly thrown away because the workmen could not unravel them, are now made valuable by the use of ingenious and effective machines. These machines take the rag or piece of silk at their entrance, and restore it at the exit in the form of filaments, classed in lengths and fineness proper to be submitted to the machines for decomposing the *chiffon* or rag. These machines were not exhibited at the Exposition by the inventors, from fear of imitation by countries where inventions are not protected by patents.

Referring to the dyeing of silk, Mr. Cowdin says:

"The invention of those colors derived from coal has principally contributed to or caused a revolution in the art of dyeing. The new materials

have permitted dyers to obtain colors of unprecedented splendor, combining shades of marvellous variety with extreme delicacy. Looking through the Exhibition we might almost say, in the presence of results obtained in this direction, there is now nothing impossible. Still, close by the side of products so admirable in respect to dyeing, we saw, on the contrary, much still left to be accomplished. We refer to the attempts made for some time to gild and silver threads of silk. Some specimens of silk of this kind exhibited denote processes still in a crude state, which do not yet supply any product capable of being used to advantage."

The plain silks of France, Switzerland, and Northern Germany attracted great attention on account of their thorough finish and general excellence. They were exhibited with the special notice that the weaving was done by motive power. The improvements in the looms of these nations secures cleanness, purity, and brilliancy. A French apparatus has been introduced to polish plain stuffs automatically. This machine possesses all the advantages of hand-polishing, acting with only a little polish and in parts. Automatic looms for the manufacture of velvet stuffs are of two kinds, one for working two pieces at a time, and the other a piece singly. By the former, various articles in silk, and the most beautiful plushes for hats are made. For the manufacture of striped and plaid silks the Scotch looms excel all others. In the silks for toilette, especially in *façonnés*, or figured goods, a fineness and neatness that seemed almost impossible has been attained by French industry alone. Ingenuity has been tasked to simplify the Jacquard loom and render it capable of producing still more extensive results.

At the Exposition, products of the silk-ribbon loom were exhibited by the manufacturers of Saint Étienne, Basle, Prussia, Alsace, and other sections. Saint Étienne contains 90,000 inhabitants, and gives employment to 23,622 persons, of which the greater part are women and girls. It has 15,000 looms. The value of its productions in 1866 was $12,000,000, five-sixths of which were sold to the United States, England, and to the city of Paris. Basle, with a population of 65,000, has 6,000 looms. At Alsace steam was first employed in the manufacture of ribbons. Some of the ribbon factories run 200 looms by a steam-engine of thirty horse-power, and employ 600 persons.

In the opinion of the commissioner, four of the seven industrial branches employed in the transformations of silk can from this period develop themselves in America without any difficulty, and soon take the high position already attained by cotton industry, namely:

1. The throwing of silk, consisting in the employment of apparatus more simple and also less difficult to direct than the greater part of the machines in the factories of the United States. It is as easy for the United States as for England to obtain immediately a supply of raw silk in China, Japan, and even in the Levant and India. It is not improbable that New York may become as important a depot for Asiatic silks as London now is. This may be accomplished through the medium of the Pacific railroad. The raw material having thus reached New York, will be distributed not only among our own manufacturers, but portions, doubtless, will be exported to foreign countries. Let England be taken as an example in this industry. In less than fifty years the silk manufacture of Great Britain, which does not upon her own soil produce a single pound of raw material, has arrived at such a degree of development as to give employment to a large amount of capital and to about 110,000 looms, and direct occupation to some 200,000 persons, not including those engaged in the ribbon and silk hosiery manufacture.

2. The dyeing of silk, already an established branch of American indus-

try, needs only the encouragement to be derived from the establishment of co-operative branches to compete successfully with European skill.

3. As to the regeneration and spinning of silky waste of all kinds, the United States find themselves in as good a position as most other countries to undertake a work of this sort, inasmuch as they possess equal facilities for procuring the waste and raw silk. This branch of industry in France gives employment to more than 30,000 workmen, and the annual production exceeds $20,000,000.

4. With regard to the automatic weaving of plain stuffs, the United States already compete successfully with the more experienced nations of Europe. Looms exhibited by American constructors at the Paris Exposition were highly appreciated for their ingenious contrivances and remarkable improvements.

Three specialties remain, therefore, to excel in which time and effort only are necessary, viz: The rearing of silk-worms, the reeling of the cocoons into raw silk, and the weaving of figured goods. As has already been shown in this article, the culture of the mulberry in many portions of this country has proved very successful—in some eminently so. The cocoons of California are equal to any in the world. Native silk once supplied in sufficient quantities to enlist the inventive genius and mechanical aptitude of our people, will speedily solve the problems presented in the remaining specialties just cited. The country which produces the most skillful and careful spinners of wool and cotton manufactures will not despair of arriving eventually at the successful production of the many kinds of silk goods within its province.

MANUFACTURING IN THE UNITED STATES.

The present processes in American silk manufacture are thus described in the New York Tribune, with a reference to the localities and *personnel* of the business at the present time:

"The first process is to sort the raw silk into sizes, great care being required in every stage that the threads be equal in size, as inequality would produce a manufacture of uneven and unmanageable twist. It is then soaked in soapy water to dissolve the gum and render the thread pliable and elastic. The skeins are slipped upon octagonal, wicker 'swift' reels, a dozen or more of which revolve on an axis fastened on the legs of each table. A thread from each reel-skein passes upward over a smooth metal or glass rod, fixed on the lateral edge of the table to its revolving bobbin, upon which it is wound. After this process the thread is guided between the contiguous edge of two sharp steel knives, resembling scissors, which cleans it of gummy lumps and clinging waste, to another bobbin. This process occasions considerable waste. The finer and more regular threads are now taken for making organzines, which are the warps of woven goods. Coarser threads are taken for trams or woofs. The most inferior are used for the manufacture of sewing-silks. Loose and broken ends are corded like cotton and spun into floss for embroidery. The twisting or 'throwing' process is done by passing the thread of raw silk from an upright bottom through the eye of a craned wire flyer, which rapidly spins with the top of the bobbin revolving above. This thread is called a 'single,' and for organzines receives from twelve to nineteen twists to the inch. Organzines or trams are made by twisting together two of these twisted threads in an opposite direction to the former single twist, at the rate of from ten to seventeen turns to the inch; the two threads having previously been wound parallel upon one bobbin. Organzines receive tight twisting, to induce

strength and elasticity. A swing of two twists to the inch sometimes saves five cents to the pound in the cost of labor, but may occasion greater loss in weaving. Two or three threads of raw silk twisted loosely two or four times to the inch is tram, shute, or woof. In weaving, the woof has little or no strain upon it, and it fills up the warp better by being soft and loose. The twist in silk threads is set by dampening and drying. Skein sewing-silk is made of three to ten threads twisted together, and two of these latter doubled. Sewing-machine silk is trebly twisted. Button-hole twist is the same, with a tighter twist. Twists in the single threads of sewing-silks are ten to fifteen to the inch; and the doubled, eight to twelve. The organzines are reeled into skeins of one or two thousand yards each, care being taken to make them of the exact length, as that compared with their weight determines the quality of the goods to be woven. The American sewing-silk machine is a great improvement over the old-fashioned one. By the aid of a few girls, the former at once doubles and twists the silk, and reels it into skeins of equal length; and it turns out one hundred and twenty-five pounds a week. The cost of throwing raw silk into organzines is four to five dollars per pound, a great proportion of that going to labor. Trams cost less. After weighing, the threads go to the dyer, who is charged with the weight; also with the number of skeins. As the manufacturer knows how much of each color should be returned, little fraud or error can happen. Up to the time the silk goes to the dyer, there is a loss of three to nine per cent. from cleaning, breaking, &c. It loses eighteen to twenty-five per cent. of the weight in dyeing by the boiling off of the worm gum, which is made up greatly by surcharging with sugar or dye. In the dye-house the silk skeins are tied to prevent tangling, and boiled for four or five hours in coarse linen bags, by which the hempy colors attain a luster. Yellowish colors are 'counteracted' to pure white by the use of a little blue dye. This white dyeing costs sixty cents a pound—less than any other color. Of white colors the manufacturer receives back from the dyer twelve ounces for every pound. The aniline or bright colors cost $1 50 to $3 50 a pound to dye. The bright greens are the most expensive. They also return twelve ounces to the pound. High colors are cheapened in the weight by the addition of three ounces of sugar to twelve of silk. Drabs and slate are dyed with sumac at a cost of a dollar a pound, and return fourteen ounces. Blacks are dyed with nitrate of iron and cutch, and also logwood, a bluish shade, especially for velvets, being desirable. Blue-blacks return fourteen ounces; plain blacks the full complement, losses being compensated by surcharging. Surcharging can be carried to the extent of trebling the weight of the silk. After dyeing, the skeins are dried on bars in a close-steamed room, and then lustered by passing over hot cylinders. Sewing-silk is softened by wringing, and tied into skeins for sale. Trams and organzines are then rewound upon bobbins, and again rewound to give a proper tension to the thread before weaving.

PRESENT CONDITION AND PROSPECTS.

"Such is the extent to which the American trade has usually been carried, though pongees and foulards were woven in Connecticut, and ribbons in Baltimore, twenty years ago. During the last ten years the manufacture of ribbons has increased rapidly. The Cheney Brothers, of Hartford, are making great quantities of parasol coverings; the Dole Company, at Paterson, N. J., are making tailors' trimmings, scarfs, and braids;

Dexter, Lambert & Co., of the same city, make this season 3,000 yards of knotted fringes, and 2,500 yards of bullion fringes, per day, driving foreign goods out of the market. The processes of trimming manufacture are too intricate and tedious for popular description. An examination of the goods will show a delicately knotted thread, on a base of cotton wound with silk. Broad silks are woven upon the plain loom, and figured ones upon the Jacquard. The operations are delicate and costly. To get the proper length of warp for piece, and at the same time to lay a sufficient number of the warp threads together, amounting sometimes to 5,000 or 6,000, the threads from a great number of bobbins, rolling in a frame like the old school counting-frame, are reeled backward and forward together on a large reel. These again are rewound upon a large drum to give them tension and lay them the right distance apart, the operation being afterward completed by passing each thread by hand between the teeth of a large brass comb, and while they are stretched cleaning them by hand with small scissors. Narrow goods are woven upon a small adaptation of the plain or the Jacquard looms, a dozen or more of which are operated upon the same table. Watered goods are made by laying a piece of woven plain goods upon another, and passing them between iron cylinders, one heated, the tension and abrasion of the surfaces producing the watered effect. In *chiné* goods, the figure is painted upon the close warp and woven in by the woof. "Shot" goods are woven with the warp of one color, and the woof of another. For the best ribbons Italian warps are used. Bandannas and other loose goods are made of waste and cocoon covers, scutched, chopped, and spun like cotton. This "spun" is also used by some American manufacturers for the woofs of broad goods. The Murray mill, at Paterson, was about to be used in this trade before it was recently burned. Inferior silks are produced altogether from "spun," but the latter, being loose in texture, is best if used as a woof, with a web of pure silk warp, when it makes a good article.

"At the present time American silk fabrics are competing favorably with European goods. In braids and trimmings we have driven foreigners out of the market, and our ribbons are purchased as freely as theirs. But it is with broad silks that the manufacturer will experiment, and produce, and succeed, during the next ten years. P. G. Givenaud, of West Hoboken, N. J., and John N. Sterns, of First Avenue, New York, now turn out respectively several thousand yards of *gros grain* silks per week, which no man in the trade can tell *from the best imported* articles, and which retail on Broadway for $5 per yard. With the present tariff of sixty per cent. American manufacturers can throw and weave silk goods at a profit of fifteen per cent. There are now in Philadelphia thirty trimming factories, those of Graham, Horstmann, (carriage and military trimmings,) and Hensel & Cornet, being the largest. At Hartford and South Manchester, Conn., the Cheney Brothers, who have been engaged in the business for thirty years, employ 1,000 hands, and have the following capacity per annum: 60,000 pounds of thrown silk, 60,000 pounds of "patent spun," 100,000 pieces of belt ribbons, and 600,000 yards of wide goods, comprising dress silks, *gros grains*, poplins, foulards, and pongees. The Dole Manufacturing Company, which, in 1865, built at Paterson, N. J., a mill probably as large as any in Europe, having a mean length of 375 feet, and a height of four stories, turn out 3,000 pounds of manufactured threads per month, 1,000 gross of silk braids, 600 gross of hat bands, and 3,500 yards of serge, performing within the mill every operation necessary to produce the goods from the raw thread, and employing 300 hands, mostly children of Paterson machinists. John N. Sterns,

of New York, is making 400 yards of woven goods per day, and M. Givenaud over 300. Dexter, Lambert & Co., at Paterson, N. J., make 60,000 to 75,000 yards of dress trimmings per month, and during the past spring season, manufactured 12,000 dozen yards of bullion trimmings. Hamil & Booth's Passaic Mill, beside making trams and organzines, is employed in the manufacture of dress goods. Nearly all the Paterson mills are engaged in this specialty, the Dole Company having introduced a large number of improved American looms; and the Murray mill, which was burned in May, but will be rebuilt, will be employed in weaving broad goods of net warps and "spun" fillings. American dyers are succeeding in producing as fine shades of color as the French. Claude Greppo, at Paterson, with thirty-five dyers, some of them from France, is daily turning out 350 pounds of dyed silk, the colors of which are equal to any produced at Lyons or Saint Étienne. The American velvet mill started at Paterson a few years ago failed. New York City contains probably fifty establishments for various grades of the manufacture; many of them are small. At Schenectady, Troy, and Yonkers, are also several mills. Paterson is the headquarters of the trade and contains fifteen factories. The operatives are mostly children of mechanics, the majority of them girls, who earn from $4 to $7 per week. In the trimming and weaving mills, skilled operatives brought from Lyons receive as much as $35 a week for piece work during the spring season, and girls trained to the labor can earn $9 and $10 a week. Some of the mills in Connecticut and Hoboken employ operatives, as in Europe, to take the materials and weave the goods at home."

THE ANNUAL PRODUCTION OF SILK.

The annual production of raw silk is estimated at $214.000,000, of which America is credited with a mere trifle at present; but twenty years will probably make a great change. Eighty years ago the value of the silk goods manufactured annually in France was $5.000.000; now it is $150,000,000. The silk industry has not made so much progress in Germany, Spain, or Italy, yet it has also made great advances in those countries, and it promises to make great advances here.

This manufacture is so great and profitable, and is extending so rapidly, that the people of the United States should make their best efforts to get possession of a part of it.

SILK CULTURE IN CALIFORNIA.

The breeding of the silk-worm in California has been commenced so extensively, and so profitably, and there is so much probability of its rapid extension, that it is already regarded as one of the most promising industries and important resources of the State. It has thus become an interesting branch of our national agriculture, and a proper subject for study by those who desire to keep pace with the material progress of the country. It pays well, and carries with it many branches of manufactures which require costly machinery, high mechanical skill, and artistic labor, all of which will contribute to enrich the nation. The business is capable of great development. The market has never yet been overstocked, nor is it likely that it ever will be, so long as it is fashionable to wear the textile fabrics now in use. The best raw silk sells readily for its weight in silver, and France obtains seven times as much money from her cocooneries and silk factories as Mexico does from her mines,

INTRODUCTION INTO CALIFORNIA.

Among the pioneer settlers of California was Louis Prevost, an enthusiastic Frenchman, who had bred the silk-worm in his native country. Soon after establishing himself in the valley of Santa Clara, he became convinced that the climate and country were peculiarly adapted to the production of silk; so he imported mulberry seed, made a nursery, and set out some of the trees in a plantation, but had much difficulty in getting live eggs. He succeeded in interesting Henry Hentsch, a Swiss banker, in his schemes; and that gentleman, in 1857, imported a lot of eggs, all of which were dead, or were hatched on the voyage, and the worms died before reaching California. Another shipment the next year shared the same fate. In the third shipment a few eggs arrived in good order, and, in 1860, Mr. Prevost had the delight of seeing himself in possession of California cocoons, which, in size, luster, color, and every desirable quality, were far superior to the average of the European cocoons. Although he had not given half so much time to the worms as is given in France, they were all very healthy, and he did not hesitate to advise all his friends to go into the silk business as a source of profit. Unfortunately, after having failed for several years in his attempts to get live eggs, he had dug up most of his mulberry trees, so that he was not prepared to feed many worms, and, besides, he had not enough money or the credit to justify him in devoting himself entirely to an occupation which would not give him a return for several years. His progress was, therefore, slow. In the fall of 1860 he had 500 eggs; he began the year 1862, with 2,000; 1863, with 3,000; 1864, with about the same number, and 1865, with 100,000.

PRESENT CONDITION OF THIS ENTERPRISE IN CALIFORNIA.

Within the last three years the increase has been great, more than 3,000,000 worms having been bred in 1868. At the State fair, held at Sacramento in September last, twenty-eight persons exhibited cocoons, and the places represented were San José, Sacramento, Santa Barbara, Santa Cruz, Hornitos, San Gabriel, Los Angeles, Nevada, Placerville, and Portland, Oregon. The cocoons were of several varieties, including the new French, old French, white Japanese, green Japanese, Chinese, Turkish, yellow Portuguese, white Portuguese, yellow Mountain, Valreas, white Oak, and wild California—varieties most of which are of no practical value, the old French being equal in the healthiness of the worms, and superior in the quantity and quality of the silk fiber, to any other. Among the exhibitors were J. N. Hoag, of Yolo County, three miles from Sacramento, who bred 1,000,000 worms, in 1868; W. M. Haynie, of Sacramento, who bred 800,000; Louis Prevost, of San José, who bred 500,000; G. E. Goux, and A. Packard, of Santa Barbara, 100,000 each; D. F. Hall, of San Gabriel, 200,000; and Mr. Garey, of Los Angeles, 20,000. The gentleman last named expects to feed 100,000 in 1869; and many others will double and treble their production. The main obstacle to progress, at present, is the scarcity of mulberry trees; but plants grow so rapidly in California that, when the entire agricultural population is satisfied that the breeding of the silk-worm will pay better than anything else, the production of cocoons can be raised to a very large figure in a few years. It is probable, from arrangements and preparations that are now being made, and from opinions expressed by silk-growers, that the number of cocoons will double annually, for several

years to come. This would give 6,000,000, in 1869; 12,000,000, in 1870; and 24,000,000, in 1871. It is supposed that there will be enough mulberry trees to feed so many, but this may be an erroneous supposition. Hitherto the business has been profitable, or at least since 1865. The eggs have commanded a ready sale, at $8 or $10 per ounce, until last summer, when the price fell to $4; now $12 are demanded, but this is too much. When the Pacific railroad is done, offering speedy conveyance, in a cold climate, to Europe, the price will probably be not less than $6. Heretofore, the shipment of eggs to Europe has been accompanied by much loss, because many were hatched or killed by the heat of the tropics. Even at $4 per ounce, however, the business will be profitable.

THE BOMBYX IN CALIFORNIA.

Under the most favorable circumstances, in California the *Bombyx mori* requires about fifty-five days to complete the course of its existence; four days in the egg; thirty-five in the caterpillar; twelve in the chrysalis; and four in the moth form. The circumstances favorable to the development of the animal are a dry, warm, and quiet atmosphere in all the stages, and an abundance of wholesome food in addition, in the caterpillar stage; for, in that condition it takes all its nourishment. Neither the chrysalis nor the moth ever eats anything.

The life of the caterpillar is divided into four periods by moltings, at each of which it eats nothing for a day, and creeps out of its skin, coming out with a new dress. The first molting occurs on the fifth day, the second on the eighth, the third on the thirteenth, and the fourth on the twenty-second.

The eggs may be kept for a year in a cold place, and the caterpillar may live for four or five months, if the weather is cool and the food scanty or of poor quality. In Hindostan, silk-worms have been known to run through the circle of life in forty days, and in France the average period is about sixty-five days. The time spent in the chrysalis is from twelve to fourteen days in California; from eighteen to twenty in Hindostan, and from twenty to twenty-five in France.

YIELD PER ACRE.

An acre should support from 700 to 1,000 mulberry-trees, and, when four years old, they should produce 5,000 pounds of leaves to the acre; that is, 5,000 pounds suitable for feeding, and, during feeding time, without injury to the tree. Those leaves should feed at least 140,000 worms, which will produce 70,000 female moths, and these will lay 300 eggs each, or 21,000,000 in all. After deducting 5,000,000 for possible loss, we have 16,000,000 eggs, or 400 ounces for sale, or $1,600 per acre. In France the expense of breeding 75,000 worms, including the cost of the eggs, $6, the leaves, $28, the labor of two persons for forty days, $64, fire, $4, and incidental expenses, $10, amounts to $112. Mr. Prevost says that one person can do all the work in California for 75,000 worms, and the expense to the farmer who has his own eggs and mulberry plantation should not exceed $1 per ounce of eggs. At $4 per ounce an acre would thus yield $1,200 net. At $2 per ounce, the common price in France for French eggs, the net yield would be $400 per acre. Skillful French silk-growers expect to get $800 from an acre of mulberry plantation. We have followed the best authorities in stating that 5,000 pounds of leaves will feed 140,000 worms, but some writers say 5,000

pounds to 70,000 worms; and their statements must not be left out of calculations. Let us now consider the profit that may be derived from the sale of the cocoons. The acre will produce 140,000 worms, or, allowing 35,000 for loss, 105,000 cocoons, which will weigh 420 pounds, and be worth $3 per pound, or $1,260 in all. At present prices the production of the eggs is the more profitable occupation for Californians, but they should enter the business prepared for the worst contingency within the range of reasonable probability.

THE SILK-WORM DISEASE.

It is not likely, however, that the price of California eggs will fall below $5 per ounce. Europe is no longer able to supply itself. The worms in France, Italy, Turkey, and all the countries within a thousand miles of the Mediterranean, are diseased. Neither preventive nor remedy has been found. Thiers said, in a speech in the *Corps Legislatif*, that the annual loss to France by the disease is $20,000,000.

The *Revue Universelle de Sériculture* says the production of cocoons in France has fallen, on account of the malady, from 25,000,000 to 4,000,000 kilograms.* This pest has raged for twelve years, and has been growing worse and worse. The ablest chemists and entomologists have failed to discover the cause or the cure. If Europe could not import eggs, there would be imminent danger that her silk production would come to an end; and serious fears have been expressed that the disease will spread to other countries where worms are bred, and that the silk manufacture will become one of the lost or abandoned arts.

JAPANESE EGGS.

At present, France and Italy rely mainly for their supply of healthy eggs on Japan. Every year about fifty Italians, and half as many Frenchmen, go to Yokohama to purchase eggs, and pay from $1 50 to $6 per ounce for them; and the total amount of their purchases, in 1867, was 800,000 ounces, averaging $2 50 per ounce; in 1868 the quantity was twice as large, and the average price per ounce about the same. Yokohama is the main market for the sale of Bombyx eggs to Europeans, but something is also done at Osaka and Hakodadi. Kioto is the chief center of the Japanese silk trade, which has received a great stimulus from foreign intercourse, the price of silk having doubled, and the production increased twenty-five per cent. within the last ten years. For a time the eggs were sent from Japan by way of the Isthmus of Suez, but, since the establishment of the China mail steamer line, they have commenced to come by way of San Francisco and Panama; and, so soon as the Pacific railroad is done, they will cross the continent, so as not to leave the temperate zone, the loss being great in proportion to the heat and length of time spent in the tropics.

TEMPERATURE IN CALIFORNIA.

California must compete with Japan, and can do it successfully. It is admitted that the California cocoons are superior to the Japanese; they are worth one hundred and fifty per cent. more per pound; the eggs are more healthy, therefore they will command a higher price. The climate is more favorable, the production larger, and land cheaper.

*A kilogram is equal to 2.204737 pounds avoirdupois.

Climate is a matter of vast importance to the silk-worm, and in no country where much silk is grown is it so favorable as in California. The first point is temperature. The worm needs a warmth of 85° for hatching, 75° while feeding, and 65° while spinning. These temperatures are not indispensable, but they are the best. The following table shows the temperature of every month, at various points in the United States, and at certain cities in silk districts of the old world:

Places.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average of year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
San Francisco	49	51	52	55	55	56	57	57	58	57	54	51	54
Humboldt Bay	40	43	47	54	53	58	58	57	57	53	48	45	57
Monterey	50	50	51	53	56	57	58	59	59	58	54	50	55
San Diego	51	53	56	61	62	67	72	73	70	65	56	51	62
Sonoma	45	47	51	53	62	65	66	66	67	66	58	46	58
Benicia	47	52	53	57	59	67	67	66	64	62	54	47	58
Los Angeles	52	55	58	..	..	73	75	75	75	69	59	60	..
Jurupa	54	54	56	62	63	70	73	73	72	67	57	52	63
Fort Jones	31	37	43	49	54	61	71	68	62	51	41	32	51
Fort Reading	44	49	54	59	65	77	82	79	71	62	52	44	62
Meadow Valley	34	32	41	..	61	66	71	68	57	52	44	32	..
Grass Valley	27	37	38	44	49	52	63	58	53	53	43	36	46
Sacramento	45	48	51	59	67	71	73	73	66	64	52	45	59
Fort Miller	47	53	56	62	68	83	90	83	76	67	55	48	66
Fort Yuma	56	58	66	73	76	87	92	90	86	76	64	55	73
Dalles	33	40	46	53	59	67	73	70	61	53	41	33	52
Fort Hall	24	24	25	42	..	..	..	63	59	48	34	22	..
Salt Lake City	27	34	39	50	63	71	76	75	67	55	41	31	52
Fort Defiance	26	30	38	46	51	69	69	67	56	46	35	29	46
San Antonio, Texas	53	57	63	69	76	80	82	83	79	72	61	50	69
Santa Fé	31	33	40	51	57	68	72	70	61	51	38	30	50
Laramie	31	32	36	47	56	67	74	73	64	50	35	28	50
Memphis	41	45	55	59	68	75	79	78	72	58	53	40	60
New Orleans	54	56	62	69	74	79	81	81	78	69	60	56	68
Charleston	50	52	58	65	73	79	81	80	76	67	59	52	66
Richmond	33	39	47	54	65	73	77	74	67	57	44	38	56
St. Louis	32	35	44	58	66	74	78	76	68	55	40	33	55
Cincinnati	33	34	43	54	63	71	76	74	66	53	42	33	53
Chicago	23	24	32	46	56	62	70	68	60	48	37	29	46
New York City	30	30	38	48	59	68	74	73	65	54	43	33	51
Nagasaki	43	44	50	61	69	77	80	83	78	66	53	47	62
Canton	52	55	62	70	77	81	83	82	80	73	65	57	69
Ambala, India	51	60	70	80	100	96	84	86	84	75	64	56	75
Constantinople	41	42	44	50	61	69	76	74	69	61	56	41	57
Milan	33	38	46	54	63	70	74	73	65	56	45	36	54
Madrid	44	45	49	55	62	69	76	76	68	58	46	43	58
Toulouse	39	41	46	53	61	66	70	71	65	56	48	42	55

Canton and Milan are the two chief centers of silk production mentioned in the foregoing table, and they differ considerably in the matter of temperature. The former has a winter averaging 44° and a summer of 80°; while the latter has a winter of 36°, and a summer of 72°. The summer should not be below 65°; and, therefore, San Francisco, Humboldt Bay, and Monterey are not adapted to the *Bombyx*. All of California, however, except a strip within fifteen miles of the ocean, from Point Conception to Cape Mendocino, and forty miles wide north of Mendocino, and the mountains more than three thousand feet above the sea, is suitable for the silk-worm. The temperature, though not warm enough in the open air at some places, becomes so in a garret upon which the rays of the sun beat during the day. The worms thrive best, other things being equal, in a place where the thermometer reaches 65° in May, and stands about 75° in June and July, as it does at Los Angeles, and in nearly all parts of the Sacramento Basin.

MOISTURE IN CALIFORNIA.

The next point, in connection with climate, is the amount of rain-fall

in spring and summer. The following table gives the number of inches, at different points, with their altitude and latitude:

Places.	Spring.	Summer.	Autumn.	Winter.	Total.	Altitude.	North latitude.
	In.	*In.*	*In.*	*In.*	*In.*	*Feet.*	°
San Francisco	7	0	3	11	21	50	37 48
Ben[illegible]a	6	0	3	7	16	50	38 03
Sacramento	10	0	2	7	19	75	38 34
Humboldt Bay	13	1	5	15	34	50	40 46
Monterey	4	0	2	6	12	140	36 36
San Diego	3	0	1	6	10	150	32 42
Jurupa	4	0	2	7	13	1,000	34 00
Fort Yuma	0	1	1	1	3	120	32 43
Fort Miller	9	0	3	10	22	402	37 00
Fort Reading	11	0	5	13	29	400	40 28
Fort Jones	5	1	5	5	16	2,570	41 36
Dalles	2	0	4	7	13	350	45 36
Fort Defiance	3	6	4	4	17	7,000	35 44
Santa Fé	3	8	6	2	19	6,846	35 41
Laramie	8	5	4	2	19	4,519	42 12
Cincinnati	12	13	10	11	46	543	39 06
St. Louis	12	14	9	7	42	450	38 37
Memphis	11	8	7	15	41	400	35 08
New Orleans	15	19	13	15	62	50	29 57
Charleston	8	19	12	9	48	30	32 46
Milan	9	9	12	8	38	760	45 28
Rome	7	3	11	9	30	170	41 54
Padua	9	9	12	7	37	150	45 24
Paris	5	6	6	5	22	222	48 50
Dijon	7	8	9	7	31	800	47 20
Marseilles	5	2	8	5	20	150	43 18
Bordeaux	7	8	10	9	34	30	44 50
Canton	18	28	19	4	69	50	23 08

The silk-worm needs a dry climate in the spring and summer, at which seasons only it is in active life. Rain or dew on the leaves causes a diarrhea, which is fatal to great numbers; and, in seasons of storm, it is almost impossible to dry the leaves artificially. It will be observed that California is alone in having no rain in summer; and, in this respect, it has an immense advantage over France, Italy, China, and Japan. There is some rain in California in the spring, but it comes in March, before hatching commences, so it does no harm; and even the March rains are not so abundant as the May rains at Canton, Milan, or Cincinnati.

Abundant summer rains are always accompanied by violent thunderstorms, which are very destructive to the worms; and China and the Mississippi Valley are peculiarly subject to these electrical convulsions. None of the countries where silk is produced extensively are free from them; and it is left to California to prove the immense value of this exception.

HEALTH OF WORMS IN CALIFORNIA.

The superiority of the climate of California and the consequent invariably dry condition of the mulberry leaf render the silk-worms so healthy that they do not require half so much labor as in Europe. In France one laborer cannot attend well to more than 35,000; and, in some places, there is one laborer to 12,000. But in California, one attends to 100,000. Mr. Prevost, of San José, wrote, in 1866: "I have this last season raised over 100,000 silk-worms, every worm making a cocoon, and all this with my own work alone." Others have, in the same manner, bred 100,000 worms with the labor of one man.

MODE OF FEEDING IN CALIFORNIA.

In Europe the leaves are plucked off separately, whereas in California, after the worms are ten days old, the shoots are cut off with their leaves, instead of taking off each leaf separately. The shoots are laid down four at a time, crossing one another at the ends, so as to form a square. After the leaves have been eaten off, four more shoots are laid down on top of the others, and this mode of building up is continued, and the result is a rectangular pen, the top of which is green and fresh, and is occupied by the worms. It is after the second molting that the worms need the most food, and there is a great economy in feeding shoots instead of separate leaves. In Europe the droppings and the remains of the uneaten leaves must be carefully taken away, or they putrefy and make the air unwholesome, and endanger the life of the worms; but, in the dry air of our valleys, putrefaction is prevented by desiccation, and it is not necessary to cleanse the cocoonery during the last half of the life of the worm; and when necessary, it is done with less labor; because, before cleansing, the worms are moved on branches; whereas in Europe it is customary to move them on separate leaves, direct handling being dangerous to them.

Thomas A. Garey, of Los Angeles, date of November 9, 1868, gives the following history of the different feedings of silk-worms in that county during the past season. The eggs of the different crops were hatched spontaneously, without artificial heat. Mr. Garey's operations constituted his first experiment in silk culture:

The first crop of the season was hatched and fed by D. F. Hall, of San Gabriel. The eggs commenced hatching April 15; spinning was commenced June 1; making forty-seven days from eggs to cocoon. Number fed, 40,000; from 10,000 cuttings; four months from planting. Variety, Chinese annuals. The second crop, by Mr. Garey, hatched May 25. Time from eggs to cocoons, forty days. Number fed, 20,000. Varieties, Chinese, Turkish, and Portuguese annuals. Third crop, also by Mr. Garey, hatched July 5. Time from eggs to cocoons, thirty-two days. Variety, Japanese trivoltines. Number fed, 3,000; from cuttings of spring growth. Fourth crop commenced hatching August 31. Time from eggs to cocoons, twenty-seven days. Variety, Japanese trivoltines. Number fed, 98,000. Fed entirely from 10,000 cuttings between eight and nine months from planting. Fifth crop, hatching at the time of this statement.

AMOUNT OF LOSS.

It is customary in Europe to allow at least twenty-five per cent. for loss of worms. One egg in four does not make a cocoon; that is, with the healthiest varieties. During the last ten years, since the prevalence of the silk-worm disease, the loss has risen to an average of fifty per cent. among the peasants or small silk-growers, and seventy per cent. among the large proprietors. In making calculation of the production of eggs in California, we have allowed for a loss of 5,000,000 out of 21,000,000, but no such loss has occurred there among those who possess competent information, and have given care to the business. Out of a lot of 80,000 worms, bred by Mr. Prevost, in 1867, he did not, so far as he knows, lose one, although he fed them with branches. It is not to be supposed that every lot of eggs could be hatched, and the worms be bred, without loss; but a saving of ten per cent. would go far to compensate for the difference in wages between France and California.

CARE OF THE WORMS.

When the eggs begin to hatch, they are covered with leaves, and every evening the leaves are changed, all of one day being kept carefully separate from those of another day. Twenty-four hours are an important period in the life of a young worm: and all of the same age, that is, all born on the same day, are kept together, or managed in the same manner. On the sixth day they begin to molt, or change their skin; and, while molting, they must not be disturbed, even by putting leaves over them. If worms of two ages were together, the older ones would be disturbed while molting by the feeding of the young ones. The injury to the worm, by disturbance, is greater in the later moltings, and greatest in the last. For one pound that is eaten per day in the first age of the worm, four are necessary in the second, nine in the third, and twenty in the fourth. Mr. Haynie says 100,000 worms require thirty pounds of leaves per day in the first age, one hundred and twenty pounds in the second, two hundred and eighty pounds in the third, and six hundred pounds in the fourth and fifth. During the last two ages they should be fed at night, as well as in day-time.

The cocoonery should be dry, sweet, well ventilated, roomy, warm, equable in temperature, and well lighted, but none of the worms should be exposed to the rays of the sun. When spinning time comes, the worm prefers darkness. Some small twig-like material, with spaces about an inch wide, should be provided. Willow branches, dry mustard, or wheat straw will do. If straw is used, it should be cut about a foot or a foot and a half long, tied together in bunches at the ends, and pressed endwise together, until the stalks are separated sufficiently in the middle. The largest and finest cocoons should be saved for breeding. The poorer ones, intended for silk, are killed by exposing them to the rays of the sun for four days, in California; but in Europe, the sun is not powerful enough, and they are roasted in an oven, which sometimes seriously injures the quality of the silk, even when much care is taken to prevent excessive heat.

JAPANESE WORMS.

We have referred only to the breeding of the "old French" worms, which make the finest cocoons. The best of these have sold at twenty-five francs per pound, while the Japanese are worth only ten francs. A Californian, traveling in Europe, had taken a couple of the old French cocoons with him: and at Lyons he showed them to a manufacturer, and wanted to know the value of such cocoons by the quantity. Before he had finished his sentence the Frenchman seized them, called his friends to admire them, and said that the country which could produce these in quantity had better wealth in its valleys than in its mines. Europe had nothing equal to them. The Californian found that, if he wanted the attention and hospitality of a French silk manufacturer, he had only to show these cocoons: they made friends for him on every side.

But the Japanese silk-worms can be bred at less expense, because four or five crops can be grown in a year. D. F. Hall, in 1868, at San Gabriel, had four crops, and says he could have had five. The French worms have been bred so as to have only one crop, though probably two could be produced without any inconvenience, or injury to the quality of the silk. The silk-grower can control by the degree of heat the time when the eggs are to be hatched; so he can have many or few crops at his pleasure. For the production of numerous crops the climate of California is peculiarly favorable, on account of the long, cloudless,

warm, dry season, which lasts from the 1st of April till the 1st of December, a period of eight months, during which the mulberry will furnish an abundance of leaves. The caterpillar requires food for about thirty-two days, and there is enough time in eight months for feeding four or five generations.

Mr. Prevost has expressed some fears that the anxiety to produce great numbers of eggs, and to make the largest possible profit within a short time, may lead some of the silk-growers to breed their worms carelessly, so that the eggs will become diseased, and the silk poor.

STATE PREMIUMS.

The legislature of California has offered several prizes to the pioneer silk-growers of the State. An act passed in 1862, promised $2,000 for the first ten bales of raw silk of one hundred pounds each, and for the first hundred bales of the same size $5,000; but it was perceived that rewards should be offered first for cocoons and mulberry trees; so another act was passed in 1866, providing that $250 should be paid out of the public treasury for each plantation of 5,000 mulberry trees of the age of two years, and $300 for the production of each 100,000 silk cocoons. The act was to remain in force for four years, and if it had been left on the statute-book, it might have bankrupted the State, at least if the interpretation of some of the silk-growers had been accepted. One demand was filed for $50,000, by a gentleman who claimed that he had two hundred plantations of mulberry trees; whereas, in fact, he had only a nursery of a few acres, in which there may have been, as he asserted, 1,000,000 mulberry plants two years old, but there was no proper plantation, in which the trees should be seven or eight feet apart, and much less two hundred plantations. The demand was rejected, and several others similar in character were not presented, though they would have been if there had been any hope of success. In 1868 the legislature repealed the law of 1866, and enacted another, which offers $250 for 5,000 or more mulberry trees two years old, planted in suitable form and at proper distances for permanent silk culture, and $300 for each 100,000 cocoons; these prizes to be paid only to those persons who do not make any claim under the act of 1866, and for trees two years old, or cocoons spun before the 2d of April, 1870. The effect of this last act has been to give a considerable stimulus to the production of cocoons, a premium of $300 for 100,000 being a large consideration, especially for the Japanese cocoons, of which four crops can be made in a year. The State may have to pay out $15,000 or $20,000 in these premiums. The amount paid for the plantations, however, will be small, for there is not one of five acres, two years old, in proper condition for permanent silk culture in the State. Most of the worms are fed out of nurseries.

At a meeting of the "State board of judges," held in Sacramento in the autumn of 1868, the following premiums were awarded for silk cocoons: To L. Prevost, of San Juan, 100,000 cocoons, $300; William M. Haynie, of Sacramento, 450,000 cocoons, $1,350; E. M. Jennings and Mary Flint, of Sacramento, 375,000 cocoons, $1,125. These awards were by authority of the act of the legislature providing for the payment of $300 for each 100,000 cocoons produced, no person to receive a premium for any cocoons on which he shall have already received a premium.

KINDS OF MULBERRY.

The business is so new, and the men engaged in it live so far apart, that except in the method of feeding, and the preference for the old

French worm, there is little agreement among them upon any new ideas, or modes of working. They have no new plans for cocooneries, or for cultivating the mulberry. They have not yet agreed upon what kind of mulberry thrives best in the State, or in different parts of it. They cultivate the *Morus multicaulis*, the *Morus alba*, and the *Morus Moretti*; and Mr. Prevost thinks that the first should be given to the young worms, and the second to the old ones; and that these two, the *Morus multicaulis* and the *Morus alba*, are the only varieties that should be grown. He is disposed to think, too, that the trees should be kept low and bushy, so that the shoots can be cut off conveniently by hand. The first nurseries were started with seeds, but now cuttings are used, and they grow readily. It is customary to plant in rows four feet apart, and about a foot apart in the row, with the expectation of digging up most of the plants and transplanting them, or throwing them away, when from two to five years old. In this manner a large supply of leaves is obtained while the plantation is still young; and this has been an influential consideration in California. The present high price of eggs may not last long, and the prizes offered by the legislature will be got only by those who make extraordinary efforts at the start.

The cuttings are made with three eyes each, and for nursery purposes they are planted in rows four feet apart, and six inches apart in the rows. The ground should be well cultivated, and kept clear of weeds. About eight tons of leaves can be gathered the first year from the acre, and thirty tons the second year, according to Mr. Haynie, of Sacramento. The leaves on a shoot must not all be picked off; at least three at the end or top must be left. In a proper soil and a favorable season, the tree will have as many leaves ten days after having been plucked as it had before. A moist soil is necessary to start the growth of the cuttings; and, after the tree is several years old, it will stand the water as well as the willow. It is, therefore, in no danger of being destroyed by occasional overflows. Nurseries can be started from the seeds, but the young plants must be shielded from the sun and frost, and carefully watered for four or six weeks.

SILK MANUFACTURE IN CALIFORNIA.

A company was formed to erect a silk factory at San José, California, two years ago, and some silk-looms were imported; but the stockholders could not agree, and the project was abandoned.

Mr. Joseph Newmann, who has the machinery, proposes to erect a factory in San Francisco. He has woven several pieces of silk from imported material; but, until the summer of 1868, no one was found in the State capable of throwing or reeling the silk properly; and no sufficient supply for manufacturing purposes has been reeled. The reeling is an important part of the silk industry, and much of the superior excellence of the French silk is due to the skill and care of the reelers. The reelers and weavers will soon be found in California, after large cocooneries are established.

THE LYONS SILK COMMISSION.

The report of the French silk commission for the season of 1868, is a document of interest to those engaged in sericulture. This commission was instituted some years ago by the French government, with a view to testing the best methods of conducting cocooneries, ascertaining the nature and causes of disease in worms, and experimenting upon foreign and domestic species, to discover their relative values.

The commission was charged especially to ascertain if it were possible to conquer, or at least to weaken, the disastrous scourge which has prevailed among the native species of worms for the last twenty years, and which has seriously threatened the existence of silk culture in France.

Every facility was given to the commission for carrying on its researches. The minister of agriculture having offered premiums to small breeders, charged the commission with their surveillance, and the reception of their reports of investigation and experiments. The extensive cocooneries directed by the commission for ten years were, in the season of 1868, wholly abandoned, and breeding and experiments conducted in a large structure, newly built, which had never sheltered a single silk-worm.

Every measure was taken to promote a thorough ventilation, yet so regulated that the worms would not be exposed to cold when the temperature suddenly changed. After the second molting, the worms were placed upon shelves, constructed of hurdles of esparto, *(Macrochloa tenacissima,)* constructed in a manner that permitted a thorough circulation of air. They were unbedded frequently, by hand and by the aid of nets. The commission state in their report that in the beginning of the experiments for the season, the leaves used never manifested a better condition of freshness, firmness, and fine growth, the only regret being that they scarcely had appeared before they showed a development which they ordinarily reach by much slower progress. This was due to an unusual change of weather. On the 1st of May it was cold, and the buds were scarcely perceptible, and on the 8th the leaves were fully developed under the influence of a sudden warmth. The resulting inconveniences were, that the leaves prematurely hardened while the silk-worms were yet too young to pierce them easily; and those eggs which had been purposely retarded in hatching, lest vegetation might not be sufficiently advanced, could have been hatched ten days earlier without disadvantage—early hatchings affording better promise of success than those delayed.

Diseases of the silk-worm.—In addition to the carefully conducted experiments in its own extensive nursery, the commission extended its observations to those of twenty-two competitors for the premiums offered by the minister of agriculture, and closely followed the processes in many others. These collected observations necessarily enabled the commission to present a number of facts and conclusions of great practical importance to silk-growers.

In the year 1868, it was found that the silk-worm disease presented an entirely different character from that of previous years. The *pébrine*, formerly the cause of so much havoc in nurseries, scarcely showed itself. Out of forty or fifty nurseries examined, two only showed any signs of the disease. *Pébrine* is indicated by black spots on the worm, and the caudal appendage looks as if it had been burned. M. Pasteur, after long and careful experiments has established the fact that corpuscles are a symptom of *pébrine*, and by excluding each moth invaded by corpuscles from the production of eggs he almost succeeded in regenerating the race of silk-worms.

The disease to which the majority of failures was attributed in that season was the "blight," (*flacherie*,) or death by fading or withering. In most cases the symptoms commence with a kind of numbness; the worms cannot eat, but show a disposition to leave the tables, wandering on the edges as if to escape; finally, they die, having every appearance of health. This disease, which has prevailed more or less every year, has been considered accidental, produced by the weather, by qualities of food, kind of ventilation, or other occasional cause.

On account of its universality in the year 1868, and the almost unanimous reports that it was the principal cause of all the failures, the commission arrive at the conclusion that the disease is not dependent upon merely local or accidental causes. It was found that the disease appeared in different places, at different times, under entirely different conditions. In 1867, the disease was attributed to the wet and cold season; but in the following year, warmth and drought predominating, its ravages were greater than ever. The malady would therefore seem to be contagious, and is assuming alarming proportions. To such an extent did blight prevail in the year under review, that the commission is obliged to acknowledge that French and Italian silk production was important only by reason of the introduction of eggs from Japan. The commission therefore strongly urge the French silk-worm breeders to provide themselves with eggs of the Japanese species of the best quality, of which Italy, Spain, and even Syria procure large supplies.

The commission is not without hope that science will eventually rescue the French species from the destruction threatened by the fearfully prevalent malady of "blight."

Concluding this branch of the subject the commissioners say:

"If we may trust the numerous reports of those who say they have found sure means of success, we should be tempted to believe that we shall speedily reach the end of this ill-fated period, which has continued for twenty years; but your commission, to whose knowledge a multitude of facts has come concerning all points of silk culture, still adheres to the opinion that, as it appears certain districts have been abandoned by the scourge, and the locality seems to have more influence upon the success of breeding than the choice of eggs, the malady is still far from being expelled. For, if we may depend upon the information which has reached us, the same eggs chosen and incubated under the direction of M. Pasteur, which have perfectly succeeded in certain districts, as for example in the departments of Var and the Lower Alps, have not had anything like such happy results in other localities."

Corpuscles.—The commission gave close attention to microscopical studies. About four hundred observations were made and registered, each of which was submitted to a series of nineteen or twenty examinations. These gave convincing proof that by far the larger portion of moths without corpuscles emanated from successful breedings, and that corpuscular moths were derived mainly from partially successful breedings. As indicated, there were exceptions. Some of the most successful breedings showed moths corpuscular in a very high degree, while on the other hand, breedings which had proven failures produced moths entirely free from corpuscles. The results, therefore, cannot be adduced as positive facts from which to draw absolute conclusions.

Successful methods.—A number of examples are given of novel methods practiced by breeders, which have resulted satisfactorily. Comparing these methods, many of them will be found diametrically opposite, yet producing equally good results. It is therefore thought that, by classifying and generalizing these means, it may not be impossible to establish a system whose broad principles will still allow latitude to individual efforts and theories. One breeder succeeded by hatching very early in the season, in the beginning of April, and feeding the young worms with leaves of the snake-weed. They were fed infrequently, but did not seem to be much inconvenienced thereby; when the leaves became abundant they grew rapidly. From the 10th to the 15th of June, forty-seven grams (the gram is equal to 15.43 grains) of eggs of African origin yielded 120 kilograms (a kilogram

is equal to 2.204737 pounds) of beautiful cocoons. These worms had lived two months and a half, whereas forty to forty-five days are generally allowed to their worms by breeders. The theory of this breeder is, that the organs of life, on account of the longer time allowed for their development, acquire greater strength, which enables the worms later in the season to resist evil influences.

Another breeder moves his worms from one place to another. The worms, hatched and nursed up to their second molting, are removed to a distant point, and cared for until the end of the third molting. Before the fourth molting they are again removed to a place having a northern exposure, where they finish their cocoons favorably. Ten grams of eggs yielded about seventeen kilograms of cocoons of excellent quality.

M. Roland, of La Guillotière, conducts his breeding in a low-vaulted room, receiving light from only one large aperture. This gentleman, noticing that the worm excrements emitted ammoniacal exhalations, which he considered detrimental to their health, neutralized them by nitrous vapors obtained by the decomposition of azotic acid with iron. This vapor was employed at each molting. For the twelve years during which he has practiced this method, he has been invariably successful.

The Messrs. Perret, at St. Fond, also use acid vapors. During the three years in which they used the vapors of hydrochloric acid, they had complete success.

Still another breeder, believing that his worms would be better protected from late cold weather by slower hatching, does not bring out his eggs until about the 9th or 10th of May. The progress of his experiment is perfect and rapid, and in thirty-five days he has very beautiful cocoons—five grams of eggs yielding nine kilograms and seven hundred and fifty grams of cocoons.

M. Langier, a leading silk-grower in St. Georges de Reneins, obtains good results in making daily selections in his cocoonery. Worms which do not show the most perfect health are carefully removed. He asserts that his method is infallible and in the end economical. He also feeds his worms with mulberry leaves, the branches of which have absorbed the principle of tannin from immersion in quercitannic acid mixed with water; hoping, by this means, to impart strength and vigor to the worms. Some he feeds with leaves, the stems of which have been plunged into a weak solution of iodine.

The commissioners declare it their purpose to follow up these methods and experiments with care in the future, premising that they need as yet the sanction of time and success to be declared of real value.

Egg production.—The commission exercised great care in the choice of eggs. Before cocoons were purchased, they were submitted to microscopic observation, and only the best chosen. The eggs having been laid, the moths were examined through the microscope, and the eggs of corpuscular moths put aside, as not fulfilling the conditions necessary to good breeding. Several lots of the native species yielded good results. The Japanese cocoons succeeded so well, that it was thought that the eggs might maintain their good qualities for several years.

M. Tabet, a rich proprietor in Lebanon, Syria, in a letter addressed to the commission, states that the eggs from Cyprus, Candia, and Egypt, having failed in 1863, in consequence of disease, Japanese eggs were introduced with good results. The cocoons were not rich in quality, fifteen to twenty kilograms of them scarcely yielding one kilogram of silk; but after five years of reproduction, this species has become acclimated, and steadily improves. The cocoons have increased in size

and the quality of silk is finer. In their fourth year of reproduction, the cocoons of Japanese origin returned one kilogram of silk for every twelve kilograms of cocoons. This is cited as a return equal to the most advantageous the French species can realize. It is asserted by the commission that in all their experiments during the season of 1868, only the eggs directly imported from Japan yielded satisfactory and complete results. Three boxes, containing from sixty to seventy grams of eggs, produced 110 kilograms 500 grams of perfect cocoons, there being among them not more than from ten to twelve per cent. of double ones; while other importations of this species, this year especially, gave twenty to forty per cent. of double ones. This is one of the greatest inconveniences of the species. But the good results in the case of the three boxes was due to the care and precautions taken at the moment of climbing, in preventing the moths from clustering at the foot of the brush.

Finally, as the result of their investigations for the season of 1868, the commission set out the following

Conclusions.—1. The yield in France has been this year (1868) rather above than below that of last year; perhaps one-fourth of an average crop.

2. The greatest part by far of the French production has been realized from cocoons of Japanese origin.

3. The regeneration of the French species, though showing marks of improvement in some districts, is yet very far from being complete and general.

4. The silk cultivation in France is not as yet out of danger from disaster, as many have prematurely proclaimed.

5. Science must still continue its researches for the purpose of conquering the new phase of the disease of silk-worms, which having suffered for twenty years from *pébrine* are now decimated by *flacherie* (blight).

6. It is untimely and even dangerous to proclaim the discovery of an infallible remedy against the scourge, since such an imprudent allegation may stop to a certain extent the importation of good eggs from Japan.

7. French silk-growers would act wisely in taking the necessary measures to procure Japanese eggs of the very best quality, and, above all, not to allow themselves to be forestalled as they were last year by the Italians, Spaniards, and Syrians.

8. Breeders are strongly entreated to repeat the experiments mentioned in this report as having obtained good results, and to make the success of their observations known to the commission, with the hope that among so many methods, there may be found some one which may be safely recommended as efficacious.

9. Finally, the attention of all silk-growers is called to the following recommendations:

First. Endeavor to effect early hatchings.

Second. Do not heat the cocooneries, except in cases of urgent necessity.

Third. Do not close up the crevices.

Fourth. Give to the worms the freest possible ventilation.

Fifth. Never forget to remove with the greatest care worms of doubtful health.

By following these precepts, breeders will have done all in their power to obtain success, and if the result does not respond to their efforts, then, as long as the influence of disease is unabated, they must be prepared, in spite of all the care bestowed, for great uncertainty in the crops.

PRACTICAL ENTOMOLOGY FOR FARMERS' SONS.

HOW TO COLLECT AND PRESERVE INSECTS.

If agricultural losses from insect depredations exceed in amount the total value of the cotton crop, or equal half the average value of the corn crop, as some entomologists affirm, it is time that young farmers should learn the names, study the anatomy, and investigate the habits, of these prolific pests of the farm, and thus acquire the means of limiting their reproduction, of accomplishing their destruction, or of "flanking" their movements as to the time and manner of their attacks. Much may be done in these directions, and more can be learned, as observers and experimenters in practical entomology increase in numbers and advance in the practical application of this branch of natural science.

How shall the boys of the farm commence such a work? First in order, the elementary principles of entomology should be studied; then the practical labor of making a working collection should be undertaken, from which incidental and valuable advantages would accrue, even if the threshold only of the science should be passed.

Many a farmer's boy might make a valuable collection of insects with half the disadvantages under which city collectors labor, if he would only manifest sufficient interest to make a beginning, if ever so small. One of our leading entomologists first became interested while working at his tailor bench, by catching wasps of different gaudy colors, and pinning them up around the walls of his shop; and others have become famous with no greater beginning. Probably the idea of entomology, or of a collection, has suggested itself to but few of the boys of the farm; as one recently wrote, when about to commence the study of entomology, "I never supposed a country boy could collect insects; only those who have time for study and travel." It is a great mistake. A country boy has every facility; he is where he can study to the greatest advantage the insect foes with which he has to contend, where he can watch them in all their changes and transformations, and where he can not only aid materially the agriculturist, but serve the cause of science.

If farmers in this country knew more of entomology, or were better acquainted with "bugs," as many term them, such knowledge would be the means of saving thousands of dollars to productive industry and to themselves. One can hardly realize the extent of injuries done by these little depredators; but the following estimate from the American Entomologist of September, 1868, representing more than the total value of the cotton crop, is a startling indication of the importance of the subject: "On the whole, we are certainly speaking within bounds when we assert that, taking one year with another, this country suffers from the depredations of noxious insects to the annual amount of three hundred millions of dollars."

Regarding the writings of Dr. Fitch on the noxious insects of New York, it further states, as the opinion of prominent and enlightened agriculturists, that they had saved that single State fifty thousand dollars annually. If such results are reached through the efforts of one

man, what may not be accomplished with many workers in the field? As all insects are not injurious, and as many are beneficial, it is of practical value to the agriculturist to be able to discriminate between friends and foes; and this knowledge is learned only by observing the habits of the insects themselves.

A treatise on entomology is not here proposed, but simply a few practical hints on the collection and preparation of insects, hoping they may awaken an interest that will lead to progressive study of this interesting science.

Insects, as well as worms and crustaceans, (lobsters, crabs, &c.,) belong to that division of the animal kingdom known as *Articulata*, that is, composed of rings or segments. Insects may be distinguished by having the body divided into three distinct sections: head, thorax, and abdomen; and by having two *antennæ* or feelers, four wings, and three pairs of legs. In flies the second pair of wings are wanting, and some few insects have none at all. This class is most commonly divided into seven groups, called orders; and these again are separated into families, tribes, genera, and species. An insect, after it is hatched from the egg, is called the *larva*, which when full grown casts its skin, the outer integument hardens, and it becomes a *pupa*, in which stage it remains till it has completed its transformation, when it comes forth a perfect insect or *imago*.

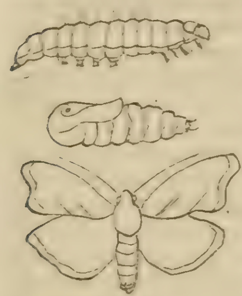


Fig. 1.

The transformation is called complete when the changes to pupa and imago are signally marked, as shown in the accompanying figures. Bees, butterflies, &c., are examples. In grasshoppers, &c., the transformation is partial, as the insect at no period of its existence becomes inactive or ceases to take food, but grows by repeatedly casting its skin, finally appearing in the perfect state. Among insects the females differ from the males, being larger and not so brightly colored; they are often differently marked or ornamented, and generally have one less abdominal ring. The signs used to distinguish them are ♂ male and ♀ female.

COLEOPTERA.

Beetles are distinguished by their hard bodies, stout jaws, and thick wing-covers or *elytra*, which in meeting form a straight line down the back, and serve to protect the second pair, which are membranous. The larvæ, called *grubs*, generally have six true legs, and often a terminal pro-leg. In the pupæ the legs and wings are free or unconfined. Transformations are complete.

The collector in this order should be provided with a net for sweeping grass and herbage, or for beating bushes; a collecting box and several vials of alcohol, in which to kill and preserve captures. The net is made in the same manner as the gauze net for butterflies, substituting cotton cloth for muslin. The common net may be used for this purpose, though it is more easily torn or otherwise damaged. A water net is particularly useful in collecting aquatic coleoptera.

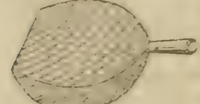


Fig. 2.

It is made of grass cloth or some coarse material, fastened to a ring a foot or more in diameter. Any box two inches deep, that can be carried in the pocket, will do for a collecting box, though for general collecting it is well to have such a one as Fig. 3, which any carpenter can make

for a trifle. A convenient size is nine inches long, by seven wide, and two inches deep at the sides; the bottom to be made rounding, to fit the small of the back. On one end is placed a cushion for pins, and on the outside of the cover a pocket for slips of paper, &c. It should be made as light as possible, and can be carried either suspended from the shoulder, shot pouch fashion, or fastened to a belt around the waist. Delicately colored beetles, the goldsmith beetle, for example, which is of a beautiful metallic yellow, should be left in alcohol only long enough to kill, and should then be pinned and placed in the collecting box. Sometimes, if not quite dead, a little benzine brushed on the sides of the body is necessary to quiet them.

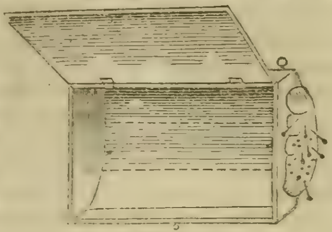


Fig. 3.

In setting beetles the pin is inserted into the right elytron, or wing-case, so as to come out beneath, mid-way between the second and third pair of legs, otherwise the insect is liable to be damaged. It is always best to place the legs and antennæ in a natural position, so that all the joints can easily be seen. When it is desirable to show the under wings, the regular setting board may be used. Beetles that are too small to pin, flea beetles, &c., should be mounted on triangular slips, through which the pin can be thrust. They are made of bristol board, cut first into strips a quarter of an inch in width, and then transversely, as shown by the dotted lines in Fig. 4. To these, insects are fastened either by common mucilage, or a mixture of inspissated ox gall, gum arabic and water; it should be thick enough to hold the specimen in the position in which it is placed. When there are duplicates of any species, it is well to set one or two in position to show the under side of the body.

Fig. 4.

Beetles are to be met with everywhere. The tiger beetles, *Cicindelidæ*, inhabiting hot, sandy plains, or sunny paths, are most easily taken by allowing them to alight, and then suddenly throwing the net over them. Ground beetles, *Carabidæ*, are found in damp places, under sticks, stones, drift, and bark of trees; a few are found upon the leaves of trees and plants. Other families are aquatic, such as the whirligigs and divers, *Dytiscidæ*, *Gyranidæ*, and *Hydrophilidæ*, and should be taken by means of the water net. By dredging the bottom of ponds and examining the plants, &c., brought up, many small species can be obtained. The *Silphidæ* (burying or sexton beetles, scavengers, &c.) are found with dead animals, and sometimes on flowers. Many of the rove beetles, *Staphylinidæ*, are found in decaying animal and vegetable substances; while some of the smaller species live under bark and in ants' nests. The *Lamellicornes*, which are distinguished by their clubbed antennæ, [Fig. 5,] are mostly vegetable feeders, and are therefore injurious. They may be collected in summer on plants, flowers, shrubbery, &c. *Copris* and allies are found with excrement. The wood-boring *Buprestidæ* may be seen on warm summer days sunning themselves on trunks of trees or on dry logs. Their allies, *Elateridæ*, (springing or snapping beetles,) live under bark or in rotten wood. The long slender wire-worms which do so much injury in gardens produce elaters. Lightning bugs, *Lampyridæ*, in the day-time are found upon flowers. *Cleridæ*, bright, nimble insects resembling ants, inhabit bumble-bees' nests. Granaries are infested with a beetle belonging to the *Tenebrionidæ*, a family resembling ground beetles, and like them found under stones, logs, bark of trees, &c.;

Fig. 5.

some live in toad-stools. Blister flies are soft-bodied insects, found on potato tops, flowers of golden rod, &c. The *Curculionidæ*, snout beetles, or weevils, infest grain, seeds, or fruits, and many species live in wood, under bark, or in plants and flowers. The *Longicornes*, in the larval state, are wood borers. These beetles, which are among the largest of the order, can be collected in great numbers in spring, around saw-mills, lumber-yards, wood-piles, and in forests; many species frequent flowers in summer. Flea beetles, *Chrysomelidæ*, live in all their stages upon the leaves of plants. The *Coccinellidæ*, (lady-birds,) which are nearly all beneficial, are useful in destroying plant lice.

ORTHOPTERA.

Cockroaches, crickets, grasshoppers, &c., are provided with jaws; the upper wings are thick and opaque, while the large under ones are net-veined, and fold like a fan. The transformations are partial, the larvæ and pupæ resembling the perfect insect, but wanting wings.

Orthoptera when collected can be thrown into alcohol, and there allowed to remain until it is convenient to set them, though a better way is to kill them with benzine or ether, and place immediately in the collecting box. To save trouble of pinning in the field, grasshoppers may be put in a little box, each insect wrapped in a piece of soft paper two or three inches square, to prevent injury, first treating it to a generous dose of benzine, which for convenience should be carried in a small vial having a brush fastened inside to the cork. Grasshoppers very soon lose their color when placed in alcohol; the delicate under wings, which in many species are bright colored, become brown and soiled. If treated with benzine, and immediately pinned and placed in the collecting box, they are also liable to injury by "coming to life and kicking their legs off," as collectors are accustomed to say. "They should be pinned through a little triangular spot between the bases of the fore wings. They are also often pinned through the prothorax, or through the right elytron, as in coleoptera." It is well to set several individuals of a species with the wings spread as in flight; some collectors prefer the wings set only on one side, leaving the other side to show the insect at rest.

The insects belonging to this order are nearly all injurious to vegetation. Cockroaches feed upon a variety of substances in houses, &c., and the *Mantes* or "rear-horses" prey upon other insects. Earwigs, *Forficulidæ*, are nocturnal insects, found hiding by day in the leaves of flowers; they may be taken with the net just before sunset, when they are most active. Many cockroaches, *Blattaridæ*, are found under stones, sticks, bark of decaying trees, and in damp situations. The field species are smaller than those commonly found in houses. The walking sticks, *Phasmidæ*, live upon the tender leaves and shoots of shrubbery and trees, and very much resemble dry twigs. Crickets, *Gryllides*, are found during the greater part of the year under logs, stones, and in sheltered places, such as old stone walls. The mole cricket, *Gryllotalpa*, burrows in subterranean galleries which it forms in meadows and swamp lands. *Katydids* represent a family of broad-winged grasshoppers, the *Locustariæ*, nearly all of which are green in color. They are found on the leaves of trees and shrubbery early in autumn, and may be collected by beating. Grasshoppers, *Acrydii*, are common everywhere during the summer months and until late in the fall. They are found most numerous in meadows and fields, on heaths and barren rocky hills, and a few are found upon bare sandy places, near streams. As many are swift of flight, the net should be used in their capture.

NEUROPTERA.

Dragon flies, lace-wing flies, May-flies, white ants, &c., are insects with jaws, having four broad net-veined wings, the second pair generally being the largest. The transformations are incomplete, larvæ and pupæ active. The species are nearly all aquatic.

The insects of this order are very predatory, and are consequently beneficial, living upon other insects in the larval and perfect stage of their existence. The habits of aquatic larvæ may be watched in the aquarium, though the more powerful should be kept from the weaker ones. In this way, with care, many additions can be made to the cabinet, altogether forming an interesting as well as a profitable study.

During the warm weather white ants are found in great numbers in rotten wood, or in rails and fence posts, and under stones. As they are very delicate, they should be pinned at once. Caddice flies, *Phryganeidæ*, in the larval state inhabit cylindrical cases made of sticks, sand, &c., living in the water, and feeding upon plants and small aquatic insects. The perfect insects are usually found flying near the pools in which they have passed their first stages, and should be pinned as soon as taken in the net. The larvæ of ant-lions live in cone-shaped pits in the sand, near which situations the perfect insects may be found. They are also found flying near woods. Lace-winged flies are found upon plants and shrubbery; and, as they are attracted to light, sometimes in the evening fly into houses. The *Libellulidæ*, "Devil's darning needles," dragon flies, &c., may be seen in warm summer days flying around pools of water, hawking for other insects. As their rapid flight makes them difficult to capture, they are most easily taken by throwing the net over them when settled. Dragon flies should be caught with the net and killed by brushing with benzine, the larger kinds placed in triangular slips of paper or old envelope corners, while the more delicate species should be pinned and put in the collecting box. They are most numerous near pools and marshes, and in damp places generally, and are attracted to fire or bright light at night. *Agrionidæ* are the small, delicate, brilliantly colored species seen hovering over plants near brooks, ditches, or in meadows, suspending themselves, apparently motionless, then suddenly alighting: they should be pinned in the collecting box as soon as taken. *Ephemeræ*, or May-flies, are most numerous in the evening. *Thysanura* is a wingless species, found in manure heaps, among fallen leaves, under sticks, stones, bark of trees, and in damp places. *Lepisma*, also wingless, is found in old books, in which it hides during the day.

HYMENOPTERA.

Bees, wasps, ants, &c., are hard-bodied insects, with four narrow membranous wings, of which the hinder ones are the smaller, and a hard ovipositor or sting at the extremity of the body. The transformations are complete. The larvæ are footless grubs, though a few resemble caterpillars. Pupæ have true wings and legs free.

In collecting hymenoptera the student should be provided with the usual net and collecting box, two or three wide-mouthed bottles of alcohol, and boxes of different sizes for nests. After capturing an insect it should be stupefied with benzine, then pinned and placed in the collecting box, or thrown into alcohol. Nests should be searched for, that their young may be reared and their habits studiously observed, especially the saw-flies, gall-flies, &c. They may be found adhering to

roofs of buildings, or fastened to the branches of trees; bumble-bees' nests are found under ground, in pastures or in old stumps. The nests of the gall-flies are the hollow swellings or excrescences seen upon the leaves and stalks of plants. When ants' nests are found, the males and females should be secured. Nests with but one opening can be easily stopped up, and nest and contents secured together; though, when separated to be placed in the collection, the same numbers should be given to both, as it is important to know the architect of each. Specimens should be pinned directly through the center of the thorax; and, where it is desirable to expand the wings, the same directions should be followed as given for setting lepidoptera. The sucking tube, or tongue, when present, should be pushed forward, that it may be easily examined. It is also well to set the legs and antennæ in a natural position. Duplicate specimens should be preserved in vials of alcohol, with the catalogue number written in ink upon parchment labels, as it is often necessary, in determining species, to examine the different parts of the body.

Many of the hymenoptera are to be found upon flowers. Carpenter bees drill holes in wood of fence posts, &c., in which their eggs are deposited in masses of pollen. The mason bee constructs clay tubes several inches in length, with from three to eight cells, laying a single egg in each. Others make their nests in sand banks, or in hidden cavities in logs, &c. Many of the social wasps may be taken in their papery nests, found pendant from the eaves of buildings or from branches of trees, while the solitary wasps, which build nests of sand, storing them with caterpillars, spiders, and other insects, are found in various situations. The wood-wasps are of moderate size, and are often seen resting on leaves in the sunshine. The several families of sand-wasps, mud-daubers, &c., build their nests in the earth, or form clay cells, such as are frequently observed adhering to the rafters of barns or in other sheltered places. The industrious little ants belong to this order; there are some which excavate galleries in stumps, though most of the species burrow in the ground. The Chalcis flies are beautiful green or metallic-colored insects, and may be collected, during summer, upon flowers. The Ichneumon flies, which are parasitical, tenanting and foraging on other insects, are most common in summer upon umbelliferous flowers. Many of the smaller species confine their attacks to the eggs of other insects. Gall-flies produce the swellings often seen upon leaves or stalks of plants, which when opened are found to contain one fleshy footless grub. The boring saw-flies, a family of rather rare hymenoptera, pass their lives as borers in the trunks of trees. The species, few in number, fly in the latter part of summer, and make a buzzing noise. Saw-flies very closely resemble lepidoptera, especially in the larval state, and, being leaf-eaters, they have been termed false caterpillars. The perfect insects also fly in summer.

LEPIDOPTERA.

Butterflies and moths—Insects without jaws, having the maxillæ prolonged into a spiral sucking tube, the wings broad and covered with dust-like scales. The transformations are complete. The larvæ are provided with six true legs, and from one pair to five of false or pro-legs. The pupa is generally inclosed in a cocoon, (except butterflies,) and has the legs and wings soldered to the breast.

This order has been divided into three groups, called diurnal, crepuscular, and nocturnal lepidoptera, or butterflies, sphinges, and moths.

Butterflies are distinguished from moths by having the antennæ knobbed or thickened at the end; while the antennæ of hawk-moths are thickened in the middle, those of moths are either simple or feathered. As these are the most delicate of all insects they should be carefully handled, to avoid injuring the specimen by rubbing the dust or scales from the wings. They are most easily captured with a gauze net, after which they may be killed with benzine or ether, or by slightly pinching the thorax, taking care to have the wings folded together over the back, then pinned and placed in the collecting box.

In making a net the ring or frame should be from twelve to eighteen inches in diameter, of heavy brass wire, secured to the socket which receives the rod, and bound with coarse cotton cloth; to this a bag made of Swiss muslin or silk gauze is sewed. In the annexed cut the best shape is given. The rod should be at least five feet long, and not too heavy to use with one hand. When the collecting box is full, or when large specimens are obtained, it is best to make use of triangular paper envelopes, or better, old envelope corners of sufficient size, in which the specimens are placed in the position shown by Figure 7; the edge is then folded over, and the whole slipped into the pocket of the collecting box.

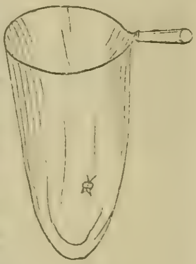


Fig. 6.

Butterflies are most abundant by roadsides, in fields and meadows, and a few species in woods. Sphinges fly just at dusk, and may be taken in the vicinity of flower beds. On warm summer evenings, with a bright light and open windows, many species of night-flying moths may be taken. A slight tap on the thorax with a ruler is sufficient to kill them. City collectors may make valuable additions to their cabinets by visiting, at different hours of the night, the street lamps. Not only are many comparatively rare moths taken in this way, but a variety of other insects, especially beetles. An excellent method for out-door collecting is to spread a sheet where there are trees, placing in the center a bull's-eye lantern; the light will attract the specimens, which are more easily seen by means of the sheet, and are then taken in the net. Some collectors have used a mixture of rum, sugar, and molasses, of the consistency of treacle, as a means of attracting night-flying moths; and it is said the bait may be used from March to October with success. "The mixture is taken to the woods, and put upon the trunks of trees in patches or stripes just at dusk. Before it is dark some moths arrive, and a succession of comers continues all night through. The collector goes, soon after dark, with a bull's-eye lantern, a ring net, and a lot of large pill boxes. He turns his light full on the wetted place, at the same time placing his net underneath it in order to catch any moth that may fall. The best nights are those which are warm, dark, and wet."

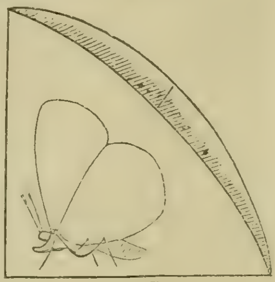


Fig. 7.

For collecting very small moths, in excursions, a wide-mouthed bottle is necessary, in the bottom of which a piece of cotton, saturated with benzine, has been placed, covered with a little dry cotton, to prevent the wings from becoming soiled. When a capture has been made, insert the bottle, open-mouthed, into the folds of the net; in this the moth will fly for escape; then, by placing the hand over the opening of the bottle, it can be withdrawn, and the insect placed in the collecting box as soon

as overcome by the fumes of benzine. Clemens gives the following directions for the same: After taking the moth in the net, "by elevating the hand through the ring, or on a level with it, a common cupping glass of about two inches in diameter, or a wine-glass carried in the pocket, is placed on the top of the left hand over the constricted portion, the grasp relaxed, and the insect permitted to escape through the opening into its interior; the glass is then closed below by the left hand on the outside of the net, and may be transferred to the top of the collecting box, when it can be quieted with chloroform."

In setting a butterfly or a moth, insert the pin into the thorax, holding the insect between the left thumb and fore finger, with the wings partly folded back, and gently push it through, leaving about three-eighths of an inch to hold it by; then place in the setting board, being careful to have the pin perfectly upright in the cork; draw the wings forward into a natural position, and secure each with a small pin near the body; then cover with card or thin pieces of glass, though in the second board, described below, thread is used, wound many times around the block, which can then be set on edge in any out of the way place. When glass is used, a slight jar may injure a whole board of insects; for this reason it is not as good a plan as the thread arrangement. In the accompanying sketches two styles of setting boards are given. The

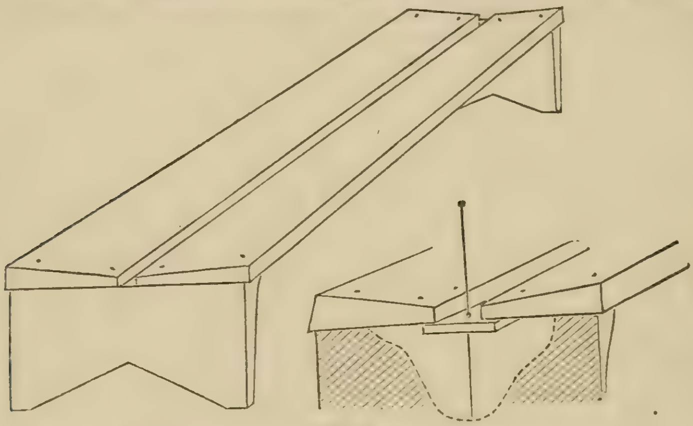


Fig. 8.

first is made by fastening two strips of wood, about a foot in length and an inch and a half in width, to two uprights of the same height, leaving an open space of half an inch between; thin strips of cork are glued on underneath, through which the pins are thrust. This size will do for ordinary use, but for very large or very small moths other sizes are required.

For the second we are indebted to Mr. Cresson, of Philadelphia. It is merely a block of wood three inches square and one inch thick, with an upper groove half an inch wide for the body of the insect, and a lower one about the same width to receive a strip of sheet cork; before putting in the cork, however, several holes should be made along the center of the groove, just large enough for the size of the pin used. Both boards are slightly sloping toward the center.

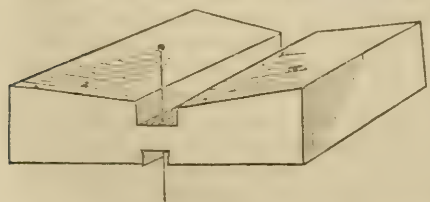


Fig. 9.

Butterflies generally *set* in one or two weeks; larger moths require a much longer time. In setting micro-lepidoptera, place the insect on a soft surface, such as blotting paper; carefully insert the pin into the thorax, and push it through the paper till the moth is in the right position on the pin. A common setting board with a very small groove may be used, or "a piece of soft cork prepared with smooth paper, and with grooves cut to admit the bodies;" or Fig. 9 may be made on a small scale, of cork instead of wood, also covered with paper. Spread the wings in the same manner as described above for larger species, only it is a much more delicate operation, and requires a greater amount of care and patience.

As entomology does not consist in simply knowing an insect in the perfect state, or being able to give its scientific name, a knowledge of its habits and transformations is necessary. To obtain this the student should collect and rear caterpillars, watching them through their different changes, and closely observing every particular connected with their metamorphoses.

The larvæ of moths are more abundant than those of butterflies, even where the moths themselves are comparatively scarce. Morning is the most favorable time to collect caterpillars. Trees should be shaken or jarred, bushes beaten over the net, or a newspaper spread upon the ground, the sweep net used vigorously among grass and herbage, and the underside of leaves carefully examined. Many of the larvæ of micro-lepidoptera are leaf miners; others draw two leaves together, feeding upon the parenchyma; and a few construct cases, which they carry about with them. The presence of "micros" is indicated by discolored lines on the surface of leaves, in which these minute larvæ mine. It may be ascertained whether the "micro" is at home by holding the leaf up to the light; leaves containing larvæ should always be carried in a tight tin box, to prevent wilting. The ground under forest trees should be examined, and, if fresh pellets of excrement are seen, the collector may sometimes secure a prize by pelting the overhanging branch, causing the larvæ to fall by the concussion. We have taken caterpillars in this way from branches twenty feet from the ground. They should always be fed on the same kind of plant on which they are found; generally they will eat no other. Besides the usual pill boxes, the collector should be provided with a couple of tin boxes, three or four inches in diameter and five or six inches deep, the top covered with gauze, in which to place the worms with an abundance of food. Oak caterpillars should be kept by themselves.

Feeding boxes may be of any size, though boxes a foot square are the most convenient. They should have good ventilation, and the atmosphere kept moist by a few inches of damp sand and earth in the bottom. For species that do not transform in the ground, light cages of gauze may be used, placing the food, which must be renewed at least once a day, in water. The worms should never be exposed to the sun. Caterpillars of small moths may be kept in wide-mouthed bottles, or even in common tumblers covered with gauze, having sand enough in the bottom to enable them to complete their transformations. For leaf miners, where it is essential to preserve the leaf till the insect has gone through with its transformations, "a glass jar, tumbler, or jam-pot," (as Packard recommends,) "the top of which has been ground to receive an air-tight glass cover, the bottom of which has been covered with moist white sand, will keep a leaf fresh for a week. Thus a larva in the summer will have to be fed but two or three times before it changes; and the moth can be seen through the glass without taking off

the cover." As the pupæ easily dry up, they should be kept moist. The pupæ of fall caterpillars do not change to the perfect insect till the following spring or summer, and during the time should be covered with damp moss and kept in a cool place.

The observer should note down the states of the different transformations in a book kept for the purpose, accompanied with full and accurate descriptions, and drawings when practicable. The food plant should be particularly given. When an insect is reared from the egg the state of hatching should be noted, the length of time required for the worm to become full fed, and the period it remains in the pupa state, as well as the state of appearance of the imago.

The swallow-tails, belonging to the family *Papilionidæ*, are among our largest and most common butterflies, and are found during summer quite common in fields and meadows. *Papilio asterias* is a black butterfly with yellow spots along the margin of the wings: its larvæ are green and black, and feed upon parsnips, celery, &c. The white and sulphur butterflies in the larval state feed upon grasses, and are green, hairy caterpillars. The different species of *Argynnis* have the under side of the wings sprinkled with spots of silver. *Satyrus* has broad wings of a delicate brown, with eye-like spots near the hinder margin; it abounds in open woods. The azure butterflies, and the class which are coppery-brown species, having a slight tail to the hinder wings, are the smallest of butterflies. The different species may be collected from May to October. The family of skippers, *Hesperians*, are rather small, thick-bodied butterflies, having the antennæ hooked at the end like a shepherd's crook. The colors are brown and yellow. The caterpillars, which are green, have large heads.

Hawk-moths, *Sphingidæ*, fly only at dusk, frequenting flowers, into which they insert their long sucking tubes or maxillæ. They are very stout bodied, and have thick narrow wings, making them rapid in flight and hard to capture. The larvæ are large, green, fleshy caterpillars, having a terminal horn-like appendage. The humming-bird moths are smaller, and have transparent wings. They fly in the sunshine, darting into flowers, or suspending themselves above them like humming birds. *Ægeriadæ*, small, clear-winged insects, with steel-blue bodies, in the larval state are borers. *Æ. polistiformis* bores into the root of the grape. The *Bombycidæ*, or spinners, including the silk-producing moths, are known by their large bodies, small sunken heads, and broad wings. The common white miller belongs to this group; its larva is thick and hairy, and is found very common in gardens. Several of the largest species, true silk-producing moths, of which *Samia cecropia* is an example, measure six inches from tip to tip when the wings are spread. The larvæ are green caterpillars, with scattering tufts of short hairs. Among the owlet moths, or *Noctuidæ*, the wings are small and narrow. As the insects are attracted to the light, night is the best time to take them. "The larvæ are tapering, and are striped and barred in different ways." The noxious *cut-worms* are the larvæ of the *Agrotis* moths, some of which may be found in fields in autumn upon flowers; while others fly only at night, and lie concealed during the day-time in chinks of stone walls and like places. The *Catocalas* have rather broader wings, the hinder ones being beautifully striped with bands of red, yellow, or black. The *Geometridæ* are easily distinguished by their slender bodies and feathered antennæ. The larvæ are known as span-worms, measuring worms, &c. Many of the species have angulated wings, generally of some shade of yellow, crossed with faint lines of darker shade. They may be taken in the woods in June and July. Delta moths, or *Pyralidæ*, so called from

the habit of placing the wings in the form of a triangle when at rest, are slender-bodied, having the antennæ always simple. They are found also in woods, resting upon the under side of leaves. The leaf-rollers, *Tortricidæ*, are found very abundant in summer, upon leaves of trees, low bushes, and herbage. The larvæ live in rolled-up leaves. The *Tineidæ*, though the smallest moths of the order, are very destructive to vegetation. The wings are narrow and edged with delicate fringe. The clothes-moth and corn-moth are representatives of the family. They are found in a variety of situations; many fly in the grass, always alighting head downward. These, with *Alucitæ*, a small family with wings, divided into numerous branches, close the order.

HEMIPTERA.

Bugs, locusts, plant-lice, &c.—This order has by some naturalists been divided into two, *Heteroptera*, or dissimilar winged insects, comprising the true plant bugs, and the *Homoptera*, or "insects with four wings of the same membranous texture, or having the upper pair leathery and the under pair membranous," as in the cicadas and leaf-hoppers. We will, however, consider them as one, and describe them as insects having a horny beak or sucking tube, four wings, the first pair of which are thickened at the base and lie flat, or are uniform throughout, and sloping at the sides. The transformations are complete. Many of the species are aquatic; a few are wingless.

The insects are collected in the same manner as beetles; sweeping from grass and herbage, by shaking or beating, or by picking them from trees or plants on which they are found. They may be preserved in alcohol without injury. (The cicadas, as an exception, keep their colors better if killed by brushing with benzine.) The water net should be used for aquatic species, which live upon submerged plants and grasses. Those that remain torpid, or hybernate, may be found in stone walls, under rubbish heaps, and in dead wood, in all stages of their growth; brush heaps afford an excellent shelter. Specimens should be pinned through the triangular scutellum in the middle of the body; smaller hard species may be placed on card slips described for coleoptera.

The harvest flies, or *Cicadas*, are very plentiful upon the trees during warm weather; the males may be discovered by their noisy song, which is produced by a drum-like apparatus under the wings on the last segment of the thorax. The seventeen-year locusts belong to this family. The tree-hoppers, *Membracididæ*, differ much in the shape of the thorax, producing many odd forms. They are found in great numbers on the leaves and limbs of trees, or on the stems of plants. The leaf-hoppers, *Tettigoniadæ*, pass their lives on the leaves of plants, where they may be collected late in summer in abundance. *Aphidæ*, or plant-lice, live upon all parts of plants, sucking the sap and destroying all vitality. Some species are apterous. Being soft-bodied insects, they should be preserved in alcohol. The bark-lice, *Coccidæ*, commonly called scale insects, are found sticking closely to the bark of trees. As they are crushed by removal, it is best to take them with a small portion of the bark to which they are fastened. The young insects escape from beneath the parent shell in the spring. The water-boatmen, *Notonectidæ*, resemble the leaf-hoppers in shape, though they are larger, and have the legs formed for swimming. They may be taken with the water net. The *Nepidæ*, also aquatic, are very predaceous. Some of the species of *Belostoma* are nearly three inches long. The *Hydrometridæ*, which are among the earliest spring insects, are seen running upon the surface of water. The

Reduvius, or wheel-bug, is found in gardens, feeding voraciously upon caterpillars, and should be handled carefully, as the wound made by its piercer is quite as painful as the sting of the wasp. The family *Reduviidæ* are terrestrial. The *Pentatomidæ* are a large family of brightly colored insects, generally oval in form, having a very large distinct scutellum or triangular piece at the base of the wings. They are found upon plants; many are of large size. The *Coreidæ* are found on the roots and stems of plants, and are very active, using both legs and wings to the best advantage. The squash-bug is an example. Many of the species are gaily colored. The bed-bug belongs to the *Cimicidæ*, which are generally wingless. Some of the family are parasites, living upon birds. The true-lice, *Pediculi*, are degraded forms of hemiptera, though still preserving the sucking tube. They are parasitic, upon man and other animals. The species of bird-lice are very numerous, nearly every bird having its parasite.

DIPTERA.

Flies, gnats, &c., are provided with a kind of proboscis, and have but two wings, the second pair being reduced to a pair of small organs called balancers or poisers. Their transformations are complete. The larvæ are footless maggots. Pupa in some cases changes inside the skin of the larva. The limbs are free. Many species are aquatic.

In collecting diptera the sweep net is found to be most useful, and particularly in new localities. After several vigorous sweeps of the net right and left among grass, flowers, and herbage, says Loew, "by a dextrous twist of the handle, the apex of the sack is thrown over the ring so as to prevent the escape of the insects, and give them time to compose themselves at the bottom. It is then opened, and the common species are allowed to pass; but if there is one that is desired, it is allowed to advance to the middle of the bag; and then it is gently grasped from the outside of the bag with the right hand. The other captures are driven down to the bottom by blowing moderately on them, and confined there by letting the ring fall over the right hand which holds the insect, that is now easily seized with the left hand." When all the "good things" are taken out, the bag is inverted and the sweeping continued.

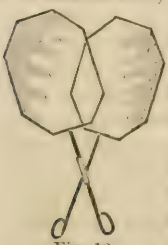


Fig. 10.

A little instrument similar to Fig 10, copied from Newman's "History of Insects," is useful for taking diptera or hymenoptera which alight on umbelliferous flowers. It consists of a scissor-like frame, with two circular or octagonal rings, covered with silk gauze or Swiss muslin.

Many specimens can be obtained by breeding, and with little trouble. Dipterous larvæ are found in dung, decayed wood of stumps, mold in hollow trees, soil under manure, stems or stalks of plants, and weeds, toadstools, &c. Many are found in water. They should be kept in glass jars or damp boxes, and not allowed to get too warm. Aquatic species can be kept in glass jars with vegetation enough to oxygenate the water. Where larvæ are known to transform at the place in which they are found, it is better to leave them till they may be taken in the pupa state.

Flies are injured by pressure, and therefore should be killed with fumes of benzine or ether, and then pinned, or pinned alive and placed in a box the bottom of which has been previously moistened with creosote. The very small or delicate species are sometimes transfixed upon fine silver wire and stuck into small pieces of pith through which common-sized pins are inserted, something after the manner of the card slips for

the coleoptera. In setting long-legged specimens, a square piece of stiff paper or card should be pushed up on the pins under the insect, and the legs allowed to rest upon it until thoroughly dry.

Musquitoes pass the first part of their lives in water, and may be seen by thousands in old rain-water barrels, jerking about when disturbed, or resting at the surface in order to obtain a fresh supply of air. They belong to the family *Culicidæ*. The crane-flies, *Tipulidæ*, are known by their long slender legs and bodies. The larvæ are found both on land and in the water; some live under the bark of trees or in damp situations. *Cecidomyia* includes the gall-flies which do so much injury to growing grain. Those species injuring wheat may be collected by sweeping in the spring. The *Mycetophilidæ* are small, active insects found in damp places; some species enter our houses. The larvæ live in fungi or decaying vegetable matter. The insects comprising the family *Stratiomyidæ* are prettily colored, and generally found upon flowers in damp situations. Some of the larvæ are found under ground, while others live in rotten wood, or are aquatic. Horse-flies, *Tabanidæ*, are among our largest diptera, and are found quite common in wood lands or pastures. The troublesome little fly which buzzes unceasingly around one's head, when in the woods, belongs to this family. The bee-flies, *Bombyliidæ*, are to be met with in April and May, in sunny paths in woods. They fly swiftly, hovering at times over flowers, extracting the honey with their lông slender suckers. The *Asilidæ* in the larval state live upon the roots of plants, preying upon other insects in the perfect state. The *Syrphidæ* are beneficial, as the larvæ feed upon plant lice. They resemble hymenoptera in shape and color. *Œstridæ*, or bot-flies, are parasitic upon herbivorus animals. The flies have thick, hairy bodies. The common house-fly belongs to a large family of insects *(Muscidæ)* which in the larval state are soft, footless grubs or maggots. *Tachina* is parasitic upon caterpillars, destroying great numbers of them. By collecting the flowers of Compositæ, and keeping them in boxes, many species may be obtained. The *Hippoboscidæ*, or spider-flies, are found upon birds and animals. Fleas are wingless flies. The different species inhabit different animals.

THE CABINET.

Specimens should be arranged in tight drawers, or in boxes fitted with covers or glass slides, and kept in a case made for the purpose; or boxes can be made in the form of books, using both sides for specimens, and allowed to stand upon regular book shelves. A very convenient size of box is nine by thirteen inches outside measurement, and two and a half inches deep. All boxes should be lined with sheet cork, and then neatly papered inside with white paper, using starch paste. Cork strips, as well as entomological pins, can be obtained at any naturalist's establishment in the large cities. German pins are always the best to use. Numbers five and eleven (Carlsbad pins) answer for most insects; for small species, lower numbers are required. The specimens should always be pinned at the same height, as a lack of uniformity gives an idea of a lack of neatness. The specimens should be arranged from top to bottom in regular rows, three or four abreast, showing as many varieties as is practicable, and a neat label be placed above each. They should be numbered, and the number recorded in a catalogue, giving the name of the insect, locality where taken, number taken, by whom, and any notes connected with its capture, as well as the date. Where several insects of a species are taken at a time under the same circumstances, or in the

same locality, one number may be used for all. Any blank book will do for a catalogue, ruling clear across the sheet, thus:

No.	Name.	Locality.	No. of specimens.	Collector or donor.	Date.	Notes.
785	Pelidnota punctata ..	Washington, D. C ...	7	J. S. King	Aug. 3, '68.	Destroying leaves of the grape.

Disks of different-colored paper, quarter of an inch in diameter, or less, may be used to represent States or localities, and the catalogue number may be written upon these. They are easily made with a common harness punch. To produce greater variation, labels of two colors may be employed.

It is desirable to have both sexes represented in every species, and when they are taken together, if not pinned upon one pin, the fact should be noted on small labels, and placed upon each pin.

Specimens of natural history are liable to the attacks of a small beetle, *Anthrenus destructor*, which consumes the interior of dried specimens of insects, leaving the shells to fall to pieces when the case is opened, or slightly jarred. Their presence may be detected by fine dust in the bottom of the box, or by the shed skins of the larvæ which do the injury. Boxes should be kept tight, and it would be well to keep a piece of gum camphor in each, though it is not advisable to rely upon it alone. The insect is oval, grayish, marked or mottled with black; larva thickened in the center, tapering at each end, and covered with short, bristly hairs. The cabinet should be examined every few weeks, and, if the least dust is discovered under any insect, thoroughly treated with benzine and left tightly closed for several days. Poisonous solutions, as a general thing, do more injury to the insects than good, by gumming them up and spoiling their appearance. As cheap benzine is apt to have the same effect, only that which is most free from oil should be used. The interior of the bodies of large moths, particularly females with eggs, should be removed, and the space filled with cotton. This not only makes them much lighter, but prevents them from becoming greasy. Mold may be destroyed by brushing the insect with benzine to which a little creosote has been added. When dampness has caused the wings of butterflies or moths to droop, the insect may be relaxed by placing it on damp sand for a few hours, when it may easily be reset. Light should always be excluded, even when glass is used for covers.

Therefore, after a collection has been made, the greatest care must be taken to keep it in order, to guard it from injury and to preserve it in its original beauty, or it soon shows neglect, and is speedily ruined.

RECENT PROGRESS IN FISH CULTURE.

The artificial propagation of edible fishes, which is shown by experiments in every quarter to be practicable, and also in a high degree economical of the material of reproduction, is assuming national importance. Admitting that it may never become one of the great producing interests of the nation, it must be acknowledged that, while it furnishes instructive popular experiments in natural history, and gratifies and educates a natural taste for rural pursuits, it undoubtedly adds to the luxuries of generous tables, and increases in some degree the food supplies of the people. That public fisheries can be improved by artificial means, at small expense, may be established by undoubted proof; and that he who accomplishes such a result is a public benefactor, will be readily admitted. If, as science asserts, a fish diet is a fortifier of the brain, who needs it more than the restless, rushing, irrepressible American?

FISH CULTURE NO NOVELTY.

The Chinese, who keep a constant supply of fish in their rivers and canals, notwithstanding the unexampled density of their population, have practiced fish-hatching successfully for centuries. Fish are there so cheap that a penny will buy enough for a breakfast for a small family. An ingenious method of artificial hatching has been adopted, which is worthy of mention, at least as a novelty. The business of collecting and hatching the spawn for the supply of owners of private ponds is extensive. When the season for hatching arrives, the operators empty hens' eggs by means of small openings, sucking out the natural contents and substituting the ova. The eggs are placed for a few days under a hen. Removing the eggs, the contents are placed in water warmed by the heat of the sun, the eggs soon burst, and the young are shortly able to be removed to waters intended for rearing them.

The Romans were adepts at fish culture. Sergius Orata, who is reported as the originator of artificial oyster beds, grew them by millions in great reservoirs at Baiæ, on the Lucrine Sea, and built a palace near for convenience in serving his famous oyster suppers. Lucullus is said to have sold his stock of fish at £35,000. Some epicures nourished pet breeds of fish, as cattle breeders perfect particular strains of blood.

WHAT HAS BEEN ACCOMPLISHED IN EUROPE.

France, England, Scotland, and Ireland, among other European states, are enjoying a manifest increase of fish supplies from artificial propagation. Many curious facts have demonstrated the feasibility of restocking the salmon rivers. Loch Shin, a lake of the Sutherland Mountains, in Scotland, having as an outlet the salmon river Shin, is fed by four rivers, the Terry, Fiack, Garvie, and Curry, which, prior to 1836, contained no salmon. In that year fish of the outlet river were conveyed in their spawning season to these streams, and ever since their progeny have passed through the lake to their native waters.

The Tay of Scotland, in which salmon, formerly abundant, became nearly extinct, has now a plentiful supply, through the efforts of the

pisciculturists Buist and Brown, at their propagating establishment at Stormontfield. The cost has been trifling. The Robe River, in Ireland, by means of a fishway two miles in length, five rods wide, with a fall of thirty feet, has assumed importance as a salmon stream. A fall in the Claregalway has been artificially surmounted, and one of the best fisheries in Great Britain is the result.

In the larger streams of France a good beginning has been made. Basins have been dug along the shores of some of them, furnished with canals for ingress and egress of the water, which have proved safe harbors for fecundated ova and the young that are too small to risk the dangers of the stream. The parent fishes voluntarily seek these artificial spawning beds and deposit their roe, where a much larger than the usual proportion of eggs will be hatched. The damage to fish spawn from city sewers is avoided by these works, wherever constructed. Two years ago there were eighty such basins distributed through thirty-five departments of France, at a cost of only $5,000—about $60 each. As early as in 1861 six millions of fish had been turned out of these basins. Protection is accorded to all fish in the spawning season; none can lawfully be taken except for fish breeding. From the celebrated piscicultural laboratory at Huningue, near Bâle, on the Rhine, supported by the government of France, millions of eggs of the Danube salmon, *(Ombre chevalier,)* and other valuable kinds, are annually distributed to the chief rivers of the country. They are packed in wet moss and inclosed in wooden boxes. People are employed to procure these eggs from the rivers and lakes of Switzerland, and from the Rhine and Danube, and are paid 1*s.* 8*d.* per thousand. The spawn of a fish weighing twenty pounds often yields to the pisciculturist a sum equivalent to eight dollars in our currency. A considerable trade has arisen in fish eggs.

It is claimed that the artificial breeding of oysters in France pays an average profit of a thousand per cent. Results have been equally satisfactory in England.

The variety essayed in operations of French pisciculture is wonderful. Even the muscle is grown artificially. Nor is this a new thing; for a muscle farm near Rochelle has been cultivated, it is claimed, for hundreds of years. The muscles are grown on frames of basket work, called *bouchots*, and are larger than those grown naturally, and of superior flavor.

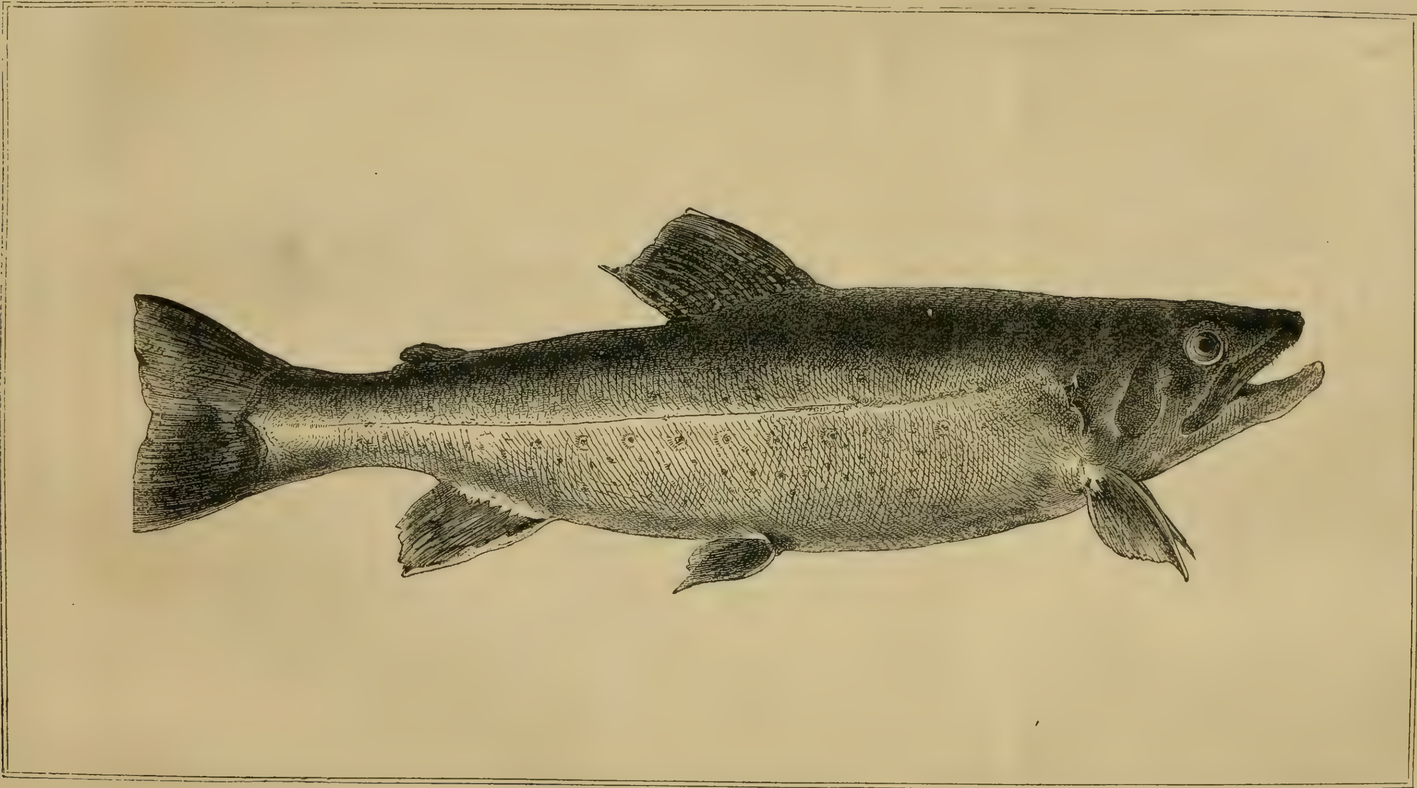
The information concerning fish-breeding experiments, with details of accomplished results, was quite full and satisfactory, as reported from all parts of France, at the International Exposition of Fisheries, recently held at Arcachon, in that country. Many rivers, almost destitute of fish a year or two previous, had been restocked to a wonderful degree.

At Concarneau, in Lower Brittany, are large *viviers* or tanks, hewn out of solid rock to the depth of ten feet—one containing only lobsters, another turbot and rock fish, and others still the nurseries of fish of various kinds. This establishment is under government management, and is self-supporting, the sale of fish more than paying the expenses.

Lake trout and salmon are bred in the Lake of Geneva, in Switzerland, by the efforts of Professor Chavannes, who receives a stipend of eight hundred francs from the government and the right of fishing in a small stream near Granson, at the south end of Lake Neufchatel.

At Cortaillod, south of Neufchatel, Dr. C. Vauga also receives eight hundred francs per annum for efforts toward increasing the lake trout in the Lake of Neufchatel. In the second year of his operations he turned out eighty thousand. He has adopted a novel method of fructifying the roe. Instead of letting the roe fall into the water, he allows

PLATE IX.



BROOK TROUT, (SALMO FONTINALIS.

it to fall upon the bottom of a clean, dry vessel, and, pouring water enough over it to cover it, he expresses a few drops of milt, so that the water, when stirred, becomes slightly colored. In about a minute he pours off the water, replaces it with fresh water, and transfers the roe to the hatching-boxes. He obtains in this way sixty per cent., while at Huningue thirty to thirty-five per cent. only are hatched.

The fish-breeding works at Huningue, near Bâle, were built in 1852, upon a plan of Professor Coste, of Paris, at a cost of 30,000 francs, and have since been greatly enlarged. Water is conveyed from springs, by an underground canal two thousand feet long, into a building, in which it is divided into three parallel canals two feet wide, the bottoms covered with gravel, and gratings laid down on which to place the hatching-boxes, which are eighteen inches long and six broad, placed in rows of four through the length of the canal. These boxes contain each two thousand roe "corns," and seven millions are annually received into tthe establishment from Switzerland, North Austria, and other regions. In 1865, four millions of roe "corns" were distributed to private individuals, and three hundred to four hundred thousand small fry were hatched. For transportation of the latter, round, tin jars are used, ten inches high and nine inches in diameter. They are half filled with water, with which air is mixed through a perforated pipe fastened to the bottom. In such a vessel three thousand three months old can be conveyed, the water being changed once in three hours.

SUCCESSFUL EXPERIMENT IN AFRICA.

The following extract from a letter received from Hon. Amos Perry, United States consul at Tunis, in Algiers, gives information concerning a profitable and somewhat novel mode for raising fish for market:

"At Bizerta, a maritime city of seven thousand or eight thousand inhabitants, situated about fifty miles from here, is a contrivance for the production of fish, which may merit some attention.

"A small stream running into the sea is widened out just above the city into a shallow pond of some sixty or a hundred acres. The water in this pond is at no time much above the level of the sea, and at times the water flows profusely back from the sea into the pond. Most of the area of this pond has been from time immemorial divided into twelve apartments, separated by an upright cane fence, which allows the water to circulate through all the apartments, and at the same time prevents the fish in the different apartments from communicating with each other. Each of these apartments is said to contain a different kind of fish.

"These fishing grounds are under municipal control. No one is allowed to approach them except the officers of the government. The officers are said to take the fish from the same apartment for one entire month, and then to leave that ground unmolested for the next eleven months ensuing.

"The fish are taken in nets at a fixed hour each day. When I witnessed the operation, several boatloads of fish were brought ashore and deposited in the government fish-house. There they were carefully sorted over. Persons from the city and from villages near by were on hand to get their daily supply, at an expense merely nominal. Most of the fish were put into baskets and sent off on camels and mules to supply the markets of Tunis and different points.

"I could not learn that any artificial means, other than those named, have ever been employed for breeding these fish. Our consular agent at Bizerta informs me that the profits realized by the government are from twelve thousand to fifteen thousand dollars a year."

WHAT MAY BE DONE IN THIS COUNTRY.

It may be said that foreign rulers may amuse themselves, and possibly attempt to aid in feeding their hungry subjects, with increase of food supplies, by the practice of the art of pisciculture, but that the fertile fields and teeming waters of this continent require no supplementary resources of an art of so doubtful productive value. With a population of forty millions, to become eighty in twenty-five years, and no one knows how soon to equal that of Europe, it is unwise to contemn any source of production, and rank folly to allow so great a delicacy as the speckled brook trout *(Salmo fontinalis)* to become extinct, as has the sea-going salmon *(Salmo salar)* very nearly upon our eastern coast. The shad *(Alosa præstabilis)* is becoming comparatively scarce in all our waters. And why should not the lakes and ponds of the East, full of yellow perch and pickerel, be stocked with the superior black bass *(Grystes fasciatus)* and white fish *(Coregonus alba)* and other valuable kinds? It has been done successfully in a few cases; why may it not be done generally?

Legislative protection.—It is an internal improvement that governments may properly favor, not by enterprises in pisciculture, but by laws for its protection. The genius of our institutions favors the remitting to local legislation of such regulations as are necessary for the conservation and replenishing of this element of food supply; and the peculiar requirements of each section may be better met by laws framed to meet the specific want. While this is conceded to be true, it is evident that the general government may properly encourage in a variety of ways and with superior efficiency the practical development of this new branch of national economy. The Report of Agriculture may appropriately show how valuable an adjunct to its store of food supply for family use the fish preserves of the farm may become. When farm labor is too valuable to be used in hunting very small game and fishing in precarious waters for obtaining a needful variety of animal food, it is at least worth an inquiry whether a cheap and abundant occasional substitute for salt pork may not be found, when chickens or eggs are not always available and roasts of beef and legs of mutton are only possible at irregular intervals. Congress may appropriately direct experiments or investigations, which would promise practical results of general acceptance, if such tests should not otherwise be made as well or as promptly; or it may introduce valuable foreign species of food fishes, such as the gourami, described in the report of 1866, if such acclimation should be deemed necessary while our native supplies are so various and so valuable.

The Commissioner of Agriculture has been urged to ask the attention of Congress to this subject by many interested in fishing and fisheries, among them Messrs. Robert B. Roosevelt and Seth Green, of the New York Commission; Royal Phelps, president of the New York Sportsman's Club; W. J. Hayes, secretary of the same organization; Francis E. Spinner, Treasurer of the United States; and many others—from whom the following petition has been received.

"The undersigned, having been impressed with the vast importance to the country of augmenting all its resources connected with the supply of food, and convinced, either from experiments made by themselves or by studying recorded facts and the experience of others, that the supply of fresh and salt-water fish can be greatly increased by a little care and attention devoted to their propagation, would suggest to you the propriety of applying to Congress for a moderate appropriation to be expended under the direction of your Department in organizing operations for prop-

agating shad in the rivers frequented at present by these valuable fish. As urgent grounds for this action, we would call your attention to the fact of the advancing price and rapid diminution in numbers yearly taken of these fish, as well as to the experiments made in the New England States during the last year, which conclusively show that shad can be readily and rapidly propagated, and that their numbers can be multiplied very largely at a small expense in time and trouble, and by means and appliances so simple that every one can understand them. Believing that this is a matter of vast national importance, and trusting that it will meet your favorable consideration," etc.

Protection for the Pacific salmon rivers an urgent necessity.—It is of the utmost importance that combined federal and State action should at once be taken to prevent the despoiling of the salmon rivers of the Pacific coast. If the strong arm of law is not interposed, but few years will elapse before the efforts of fish breeders will be called into requisition to restore the salmon to those waters. The fisheries are now worth millions. If protected, they may continue to yield millions annually; if neglected for a few seasons, they will shortly become worthless. Laws should be enacted at once, first, requiring fishways over every dam erected; second, limiting the time and mode of capture. The general government, at the next session of Congress, should enact such a law for the Territories, and the legislature of Oregon should lose no time in passing a similar enactment.

Recent State legislation.—The New York legislature amended their fishing laws, April 22, 1868, imposing upon the commissioners the additional duty of undertaking the artificial propagation of shad, white fish, and salmon in the waters of the State, and appropriating ten thousand dollars to defray the cost of the undertaking. The act prohibits the taking of shad in the Hudson, except between March 15 and June 15 in each year, under penalty of one hundred dollars and a forfeit of nets employed. It forbids fishing with any net or seine, between sunset on Saturday evening and sunrise Monday morning, and requires the opening for the free passage of fish, of all pounds, weirs, or nets during the same period. Meshes of nets or seines must measure four and a half inches in Lake Ontario, and five inches in all other waters, during the season of spring fishing.

Connecticut has a recent law restricting fishing from March 15 to June 15, and forbidding the use of meshes smaller than five inches, upon penalty of a fine of four hundred dollars; and the restriction as to the Thames River is made operative from May 1 to October 1. Salmon are not permitted to be taken until March, 1872. Three commissioners are authorized to be appointed by the governor for one year, and paid three dollars per day for actual services, and their expenses when on official duty.

The Massachusetts legislature, at its last session, enacted several important laws relating to fishing and fisheries. One prohibits the taking of shad in the Connecticut River at any other time than between March 15 and June 15, under forfeiture of one hundred dollars; and fifty dollars is the forfeit for taking salmon prior to March 15, 1872. All fishing after sunset Saturday evening and before sunrise Monday morning is prohibited, and weirs and pounds must be kept open during the same period, under penalty of a fine of four hundred dollars.

A general law, entitled "An act for encouraging the cultivation of useful fishes," was passed, the more important provisions of which are as follows: A board of three commissioners of inland fisheries is organized, each member to serve five years, and to be empowered to enforce all

fishery laws, remove (summarily, if necessary) all illegal fishing gear and other obstructions to the passage of migratory fish, and build fishways whenever individuals or corporations refuse to do so, the expense recoverable in legal action against such proprietors. The commissioners are absolved from action of trespass. Exclusive control of fisheries in ponds of not more than twenty acres, or those created by artificial flowage, is granted to their proprietors; those of greater area are public; but the commissioners may lease any of them for the purpose of cultivating useful fishes. Any riparian proprietor may inclose within the limits of his own premises the waters of a stream not navigable, provided he furnishes a suitable passage for migratory fishes frequenting such waters; and cultivated fishes are made the absolute property of the person propagating or maintaining them. First violations of this provision are punished by fines of one to twenty dollars; repetitions, five to fifty dollars. No tidal stream shall be considered navigable above a point having a channel four feet deep during three hours nearest to high tide.

A fish cultivator may take fish in his own waters at any time, and sell them even during periods when fishing is prohibited, but not at such time for food purposes. Fishing with sweep-seine, hand or dip net, with meshes less than five inches in length, in certain rivers named, between April 15 and December 15, is punishable by a fine of twenty-five dollars; and the same penalty is prescribed for obstruction by such nets of more than two-thirds of the width of a stream, or hauling a seine within half a mile of a point so fished within an hour previous.

In all of the minor streams fishing for salmon or shad is allowed in its season, only on four days of each week—Monday, Wednesday, Thursday, and Saturday—except by hook and line. Market superintendents and other officers are fined for neglect to inform upon illegal offering of fish for sale. The taking of trout and land-locked salmon by any other means than by hook and hand-line is prohibited, and heavy penalties are attached to taking or selling salmon from the 1st of August to the 1st of May, of land-locked salmon from September 20 to March 20, of black bass from December 1 to June 1, and of smelts or white bass from March 15 to June 1. All protection is withdrawn from pickerel and eels. This law was draughted and urged by Theodore Lyman, commissioner of Massachusetts fisheries, and is perhaps the most radical and protective upon the statute-books of any State.

Commissioners of fisheries.—The State governments of the eastern and middle States have already appointed commissions for the encouragement of fish culture. The following is a list of commissioners of fisheries of the several States which have taken official notice of this subject, so far as they have come in communication with this Department:

Maine: Charles G. Atkins, Augusta; Nathan W. Foster, East Machias.

New Hampshire: W. A. Sanborn, Weirs; W. W. Fletcher, Concord; Thomas E. Hatch, Keene.

Vermont: A. D. Hager, Proctorsville; Charles Barrett, Grafton.

Massachusetts: Theodore Lyman, Brookline; Alfred R. Field, Greenfield; G. A. Brackett, Winchester.

Connecticut: Henry Woodward, Middletown; James Rankin, Old Saybrook; James A. Bill, Lyme.

Rhode Island: Alfred A. Reed, Apponaug; Newton Dexter, Providence.

New York: Horatio Seymour, Ithica; Seth Green, Mumford; Robert B. Roosevelt, New York City.

Pennsylvania: James Worrall, Harrisburg.

At a recent convention of these commissioners held in New York City, the following resolutions were adopted, and may be taken as the views of these officers upon the practical aspects of this subject:

"Whereas both the marine and inland fisheries of the Atlantic States have much deteriorated, and a vast source of supply of food for the people has been greatly injured by causes entirely within the control of legislation: and whereas the present yield of fish from the salt and fresh waters could be largely increased by simple measures for their protection and propagation:

"*Resolved*, That every effort should be made, not only in the States represented in this convention but in all those which border on the Atlantic Ocean, to draw legislative attention to the subject, and to effect such modification of old laws and enactment of new ones as will conduce to the restoration, development, and protection of the public fisheries.

"*Resolved*, That the subject is of vast importance to the people, and should, by every means possible, be placed before them in its true light, in order that they may understand fully the benefit which may be obtained by the community by proper care of this valuable branch of the public natural resources.

"*Resolved*, That laws in adjacent States should be concurrent and uniform, in order that there may be no conflict between the owners of different parts of a stream or coast, and that the same object may be kept in view by all.

"*Resolved*, That fish culture, both by the artificial impregnation of the ova and by the modifications of obstructions which have reduced the natural area of the spawning-grounds of the fish, although, as yet, comparatively in its infancy, has yielded most satisfactory results, and will furnish valuable assistance in stocking or replenishing public waters.

"*Resolved*, That the true interests of the fishermen accord absolutely with the advantage of the public, and that legislation should not be hostile to them, but tend to develop this conformity, improve the fisheries, and benefit the public."

The New York commissioners recommend immediate steps toward breeding shad in the Hudson on a scale to produce early and marked results. They would use four hundred boxes with a capacity of fourteen millions of young fry daily, or three hundred millions in the season, and would require the services of fifty men, and an expenditure of ten thousand dollars. They would prohibit fishing on the Hudson after June 15, and the use of nets with meshes smaller than five inches, and all Sunday fishing whatever.

Alfred D. Hager, commissioner for Vermont, in writing concerning the restoration of the shad and salmon fisheries, declares the Connecticut to have been once as good a salmon-producing stream as any in America, though that valuable fish has scarcely been known for years within its waters, and believes "that by constructing suitable fishways over the dams, and placing the young fry in our streams, the fish will again become abundant." Concerning recent operations, he says: "The legislature of last year (1868) failed to make any appropriation for the purchase of young salmon now being raised by Mr. Stone, of Charlestown, New Hampshire, but the commissioners propose to place a few thousand in the Vermont rivers the ensuing spring. Many of the enterprising citizens of the State have commenced the culture of trout in artificial ponds, and, judging from the favorable results already attained, it is reasonable to suppose that within a few years the raising of fish for market will become one of the profitable industrial pursuits of the State."

It may not be generally known that the Connecticut, which forms the boundary between Vermont and New Hampshire, is altogether within the latter State, the line being low-water mark on the western shore.

A note from Robert B. Roosevelt, a member of the New York commission, states, as the result of his observations upon several of the southern rivers, that the shad fisheries, formerly so prolific and regarded as practically inexhaustible, are greatly depleted. The fishermen, while complaining of the reduction of their business, manifested no disposition to accept the suggestion or aid of himself or Mr. Green toward restoring their former prosperity; and the conclusion was reluctantly adopted that if anything of importance was accomplished, it must be done by the general government.

In a recent letter to the Commissioner of Agriculture, Seth Green, one of the commissioners of fisheries of New York, whose labors in fish-hatching have been remarkably successful. (and whose success has been acknowledged by the Paris *Société d'Acclimatation* in an award of a silver medal,) writes as follows:

"Last spring I visited the James, Potomac, Susquehanna, Delaware, Hudson, Connecticut, and Merrimac Rivers, and find that all the fisheries are failing, a less number of shad, herring, alewives, &c., being taken each year. The chief cause of this decline is the great amount of fishing tackle used on the rivers, the take being greater than the increase. The rivers can all be restocked artificially, but not without legislation. The fishermen want to take the last fish, but no one of them will do any hatching for fear some other fisherman may take some of the fish.

"The season varies in all the rivers. After a certain season in each river, there should be no fish taken except for artificial propagation. The rivers must be farmed from one end to the other. You might as well undertake to raise produce on one farm to feed a country, as to hatch fish enough at one fishery to stock the river. They should be hatched at every fishery, and when the fishermen put back in the river a thousand fish for every one taken out, there will be plenty of fish, and that will be done when the legislatures make laws recommended by the commissioners of fisheries. But when the fish commissioner prepares a bill, after long experience and careful consideration as to what is requisite and proper, the legislator thinks a few minutes to see if he or his friends are to be interfered with, and strokes his beard very knowingly; and there are so many such to convince that you are right, that it is almost impossible to get a bill through.

"I think the hot weather has killed a great many fish in all the rivers and bays. On the 12th, 13th, 14th, 15th, and 16th of July, the water in the Connecticut River stood at from eighty-two to eighty-eight degrees. I saw many dead shad in the river, and the fatality must have been much greater in the less rapid rivers, bays, lakes, and ponds, and I think it a serious loss to the country.

"I began to operate June 18, at Holyoke, on the Connecticut River, and hatched about forty millions of shad by July 12, when the water became so warm that it cooked the spawn in the boxes. Shad cannot be hatched successfully in water warmer than seventy-eight degrees. Shad spawn cannot be carried more than two days' journey. All the water of this country can be filled with fish adapted to them. Every acre of water is worth two acres of land if properly farmed. Most persons suppose that it can be done at trifling expense. It can be done cheap, but it cannot be done for nothing. Spend one-thousandth part of the sum spent in tilling the land, in cultivating the water, and fish may be sold in our markets at two cents per pound.

"I hatched about five hundred thousand trout last season, and sold about five hundred thousand impregnated trout spawn. Those who followed my directions hatched a fair proportion. I send the spawn to any part of the United States, by express, and have sent them to the Rocky Mountains by mail and express. The young fish can be sent almost any distance, if sent in January or February. In hot weather they do not carry well. I have trout growing in almost every State in the Union. All the spring streams in the country can be stocked with trout. I spent two weeks on the Hudson River and hatched a few shad, but I cannot do anything without legislation."

He gives minute directions for the care of the ova of trout, the mode of packing for transportation, and the proper management in hatching. He is able to send the eggs to any part of the country, or to Europe, without loss, packing in moss within a tin bucket, which is placed in another vessel, with sawdust between them to guard against sudden changes of temperature.

In January, 1869, a quantity of impregnated spawn, put up at his establishment, was sent by Mr. Roosevelt to Frank Buckland, the well-known naturalist and British superintendent of fisheries. They were packed in moss in a can, which was placed in a larger can, the space between being filled with sawdust, and forwarded in the ice room of the steamer City of Baltimore. The eggs were found in fine condition, with only one or two white or dead ones.

Mr. Green gives the following directions for handling the spawn:

"Pick the moss carefully off from the top of the spawn. Then put the box in a pan of water and turn it nearly bottom-side up, and pick the moss out carefully. The spawn will sink to the bottom, and you can pick the moss out of the pan. If there is a little left it will do no harm. Then pour the spawn in your hatching-trough, by holding the edge of your pan under water, and place them, without touching the spawn, by agitating the water with the bearded end of a feather. The dead spawn will turn a milk-white color, and should be picked out. Your trough should be so arranged that the water will run in it about twelve feet per minute. The water should be filtered by running through gravel or cloth screens, to prevent the sediment from reaching the spawn. I run about one inch of water over my spawn, and if any sediment gets on them and is allowed to remain there long, it will surely kill them. Remove all sediment with the bearded end of a quill, by agitating the water, without touching the spawn.

"Large ponds with but little water get too warm in summer and too cold in winter for trout to do well. It is detrimental to have any other fish with trout. Any kind of fish or fish spawn is good for feed. The young should be fed twice per day, very slowly; if fed fast the feed sinks and befouls the trough, and the trout will sicken and die. If fed regularly and the trough kept clean, with a good change of water, and not kept too thick, they will live and do well. If neglected they will surely die.

"The sun, sediment, rats, mice, snails, crawfish, and many water insects are death to spawn. My troughs are twenty-five feet long, and fifteen inches wide. The water that feeds each trough would go through a half-inch hole with a three-inch head. Use fine gravel that has no iron rust in it. My troughs are three inches higher at the head. The average temperature of the water is forty-five degrees, and the fish hatch in seventy days. Every degree colder or warmer will make about six days' difference in hatching. Trout hatch the soonest in warm water. The sac on their bellies sustains them for forty or forty-five days after hatching, then they need food.

"When the fish are hatched, raise the water in the troughs about four or five inches by putting on a piece of board of that width on every cross-piece, thus keeping the fish separate—about an equal number in each square. If you have a small stream of shallow water near the head of your pond, put a few in a place in the stream and pond, and they will take care of themselves better than you can. The object of distributing them is that they will get more food. All old streams and ponds have plenty of food for small trout and large, which you will find by examining the moss, sticks, and stones in your ponds and streams, as they are full of water insects.

"The fish, after hatching, should be fed twice daily for two or three months, then once a day—the grown fish once a day or oftener. For the young fish, liver should be scraped and chopped very fine, and mixed with water, to give it about the consistency of clotted blood. Toss this to the fish a little at a time, so that they can catch and devour it before it reaches the bottom of the trough; no more should be given than the fish will eat, because if any is left it will settle to the bottom and foul the water, and the fish will sicken and die. The fish may be fed on curds, fish offal, or other animal matter, provided it be small enough for them to swallow."

Trout breeding easy.—A family supply of trout may be attained with small expense and little labor by any intelligent owner of a brisk spring of never-failing cold water, if the location is so sheltered as to avoid the risk of overflow from surface drainage. Deep, narrow ponds in ravines protected from the sun's rays, and supplied by spring water through an inch pipe, may suffice for a few specimens, and serve to amuse and instruct the amateur proprietor; a fountain capable of filling constantly a two-inch pipe will sustain a trout preserve which may prove a source of pleasure and profit; a still larger stream is, of course, desirable, and essential as well, if anything important is sought to be accomplished. There are many who desire to undertake a very simple experiment in pisciculture, content with small returns in the pleasure of providing a new and agreeable feature for their homesteads, and of adding a new luxury to their table fare. To such we recommend the following directions of Theodore Lyman, one of the commissioners of Massachusetts: "The simplest hatching apparatus (without a house at all, and one at command of anybody) is made as follows: Close below a spring-head dig a trench a foot wide, so that the whole water shall pass through it gently. Fit tightly into this trench a box, four feet long, and open above and at each end; the water will now flow through this. Close the upper end of the box with a layer of coarse sponge, and below this (down stream, that is) add two flannel strainers stretched across the box. Now the water will still flow, but will be *filtered.* Close the lower end of the box with a metallic gauze, (the bottom of an old sieve, painted, will do.) and add a movable cover on top. Now you have a closed box or trough, through which a stream of filtered spring water flows constantly. Take gravel, the size of peas, wash it till clean, and spread it one inch thick on the bottom of the box. On this gravel lay trout eggs, so that they do not lie on top of one another. Examine them daily to remove the dead ones, or any dirt, and to wash the filters when necessary. They will all hatch when they get ready. But, how to get these eggs! In October or November go to a trout brook and walk softly along those parts of it that are gravelly and have running water. Peep under the banks and the dead logs until you see a pair of trout lying close together, their heads to the current. With a hand-net, dexterously used, both may be captured, and transferred to a pail of water. The female is seen to be

the stouter; she has a less-projecting under-jaw, and her fins are not so red. 'Take her up tenderly,' and do not go poking a clumsy thumb into her gills. Pass the finger and thumb with a gentle pressure along the abdominal region, and, if the fish is 'ripe,' the eggs will flow out freely. They should be received in a pan of water. Put the female back; take out the male and press him in like manner, and allow the expressed milky fluid to fall into the same pan. Stir the water with the hand, cover it, and allow it to stand for half an hour. At the end of that time the eggs which had stuck fast to the sides will become free and roll about. Now gently spread the eggs on the gravel of the trough, and the primary work is done. Should the female not prove ripe, keep her a few days in a pool or spring-hole. The fish thus captured for breeders should not be set free, but kept in a suitable pool till the next season. Such a preserve may easily be made by digging out a place a dozen feet square and three feet deep, grating the inlet and outlet, and leading a stream of water through it. The breeding fish here kept will feed voraciously, and will eat refuse scraps of meat, insects, caterpillars, clotted milk, hasty pudding boiled with milk, and small minnows. Thus fed, once or twice a day, they grow rapidly, and a half-pound fish will get to a pound in a year. Meantime, the eggs are growing also, and in their way. After three or four weeks two dark specks appear on each egg, and these, when held to the light, are seen to be the eyes of the embryo, showing through the translucent shell. This is a good time to pack eggs for transportation, Take a tin box, the size and shape of a pint measure, collect also a good handful of peat moss, (*Sphagnum*,) and wash it clean. Lay a stratum of wet moss in the bottom of the box, and cover the same with a fold of the gauze called 'musquito bar.' On this gauze spread gently a single layer of eggs, and cover them with a second fold of musquito bar. Then put more moss, and another layer of eggs in like manner, and thus continue until the box is full. Put on a cover with a few holes in it, pack the tin in a case of sawdust, and the eggs are good for a month without opening. When they are unpacked take the moss off the top, then lift them out by the gauze, and place them in the hatching-trough. It will be found that they have developed almost as much in the wet moss as they would have done in the water. The tiny embryo may be seen jerking itself uneasily in its spherical prison; a movement that continues to increase until, after two or three months from impregnation, (according to the temperature of the water,) the creature bursts its shell and appears in all its grandeur, looking, to say the truth, more like a spiritual polliwog than a real salmonide. This polliwog's character arises from the great yolk sac, or, rather call it, *havresac*, for it bears the thirty days' rations of this recruit. All that time he lies still without foraging. But thereafter we must issue to him, for now he appears as a genteel minnow, with bars on his sides. Twice or thrice a day a little clotted milk, rubbed very fine in water, must be put in the trough, and the fry may be seen eagerly to swallow the floating particles. With enough food, room, and water they will grow fast, and will take larger and larger morsels. At a year old they may very well weigh four ounces, though they may be somewhat larger or much smaller, according to their treatment. Their increase will depend on depth of water, and quantity and variety of food."

Prizes for fish-rearing.—The Massachusetts Society for Promoting Agriculture has offered two prizes, one of three hundred dollars and one of two hundred dollars, for the best two establishments for the culture of food-fishes in Massachusetts. The awards will be made March 1, 1872, and are to be determined by a consideration of the number of

species cultivated, the number and condition of individuals, the number of eggs hatched and young reared, and the neatness and economy of the establishment, and the excellence of the fixtures.

Area for fish-farming.—Few realize the extent of inland water in which fish culture can aid in the enlargement of food production. In the State of New York, for example, the area of lakes is nearly half a million acres, (466,457,) the coast line 270 miles, and the number of lakes 647. Of the larger, Cayuga is 35 miles long; Seneca, 35; Oneida, 20; Otsego, 20; Chautauqua, 18; Crooked, 18; Canandaigua, 16; Skaneateles, 16; Owasco, 12; Hemlock, 8; Honeoye, 5, and Conesus, 5. These waters are ample for the annual production of edible fish to the value of many millions of dollars, sufficient to aid materially in supplying subsistence to the dense population of the State of New York.

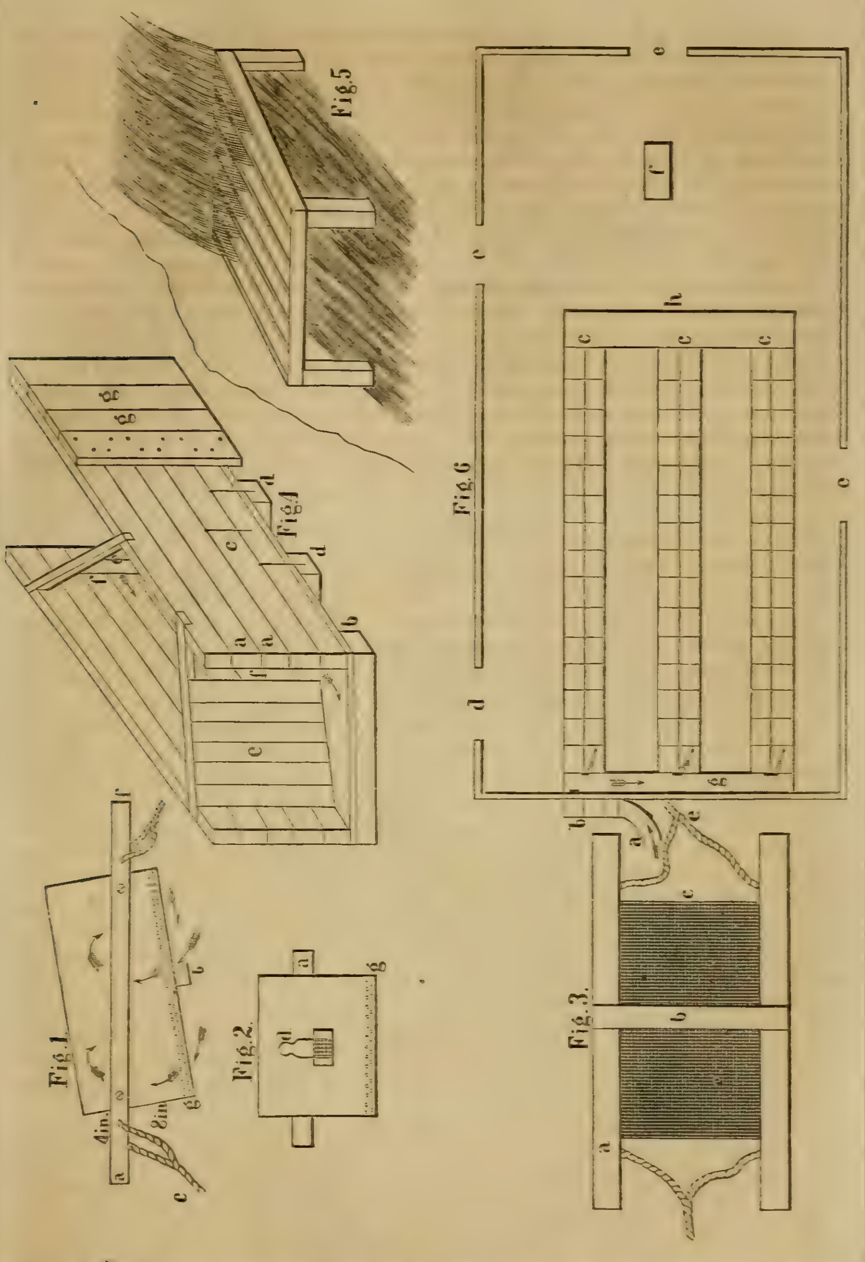
As New York is thus made to illustrate the extent of inland waters, without reference to the chain of inland seas stretching westward to Minnesota, the seaboard bays and estuaries of Maryland and Virginia, with many hundreds of miles of coast line, may serve to show how vast an area of tide-water is accessible for fish-producing and fish-catching purposes.

WHAT HAS BEEN DONE BY STATE ACTION.

As early as 1856 a commission upon pisciculture was authorized in Massachusetts, which resulted in a few experiments and a report.

In April, 1865, upon remonstrance of New Hampshire and Vermont against preventing migration of fishes by high dams on the Connecticut and Merrimack Rivers, the legislature appointed two commissioners, Theodore Lyman and Alfred A. Reed, to investigate the question. In December of the same year these commissioners reported to the governor and council, and in May, 1866, the legislature provided for the appointment of two commissioners for five years to carry out a general plan for opening the above rivers to the passage of shad and salmon over the dams. Mr. Lyman was again appointed, and Alfred R. Field was associated with him. In December, 1866, they were able to report the finishing of the Merrimack fishways, and the opening of the New Hampshire section of the river by the authorities of that State. The powers of the commissioners were enlarged in 1867, and they entered at once upon a general examination of the fishways, and commenced re-stocking the waters of the State. In June, 1868, a question having arisen relative to the liability of the proprietors of the Holyoke dam for the construction of a fishway, an appropriation of twelve thousand dollars was made for such improvement. The appropriations of the Massachusetts legislature in aid of fish culture for a single year have amounted to thirty thousand dollars.

A recent communication from Theodore Lyman, president of the Massachusetts commission, reports the progress of their official operations, and announces their success in opening several rivers, especially the Merrimack. The Lawrence fishway over the high dam at that place has been a difficult one, both from its height and the necessity of great strength as a protection against ice. Its cost has exceeded eight thousand dollars, and while it carries the fish over in its present condition, some projected improvements will render it an undoubted success. The commission has stocked ponds with black bass, and bred salmon, trout, lake trout, *(Salmo toma,)* and land-locked salmon *(S. Gloveri;)* distributed many millions of shad spawn, but failed in efforts to obtain that of the white fish, *(Coregonus alba,)* the Belgrade smelt, and the wall-eyed pike, *(Lucio perca.)*



Figs. 1. 2. 3.—Green's hatching box, side, end, and bottom; *a.* side floats, set with screws; *b.* beveled bottom cross-bar to throw the current upward; *c.* wire-net bottom, 14 wires to an inch; *d.* trap for escape of young fish, wires 8 to an inch, with covering slide; *e.* anchoring cord; *f.* water line; *g.* spawn.

Fig. 4.—Section of Foster's fish-way; *a a.* side timbers; *b.* plank floor; *c.* ten-inch spikes driven from timber to timber and into sill *d*; *e e.* bulk heads; *f f.* openings for water; *g g.* outer planking.

Fig. 5.—Horizontal screen to prevent trout passing up a fall.

Fig. 6.—Plan of a hatching-house; *a.* water conduit; *b.* strainers; *c.* hatching-troughs; *d.* door; *e e,* windows; *f.* stove; *g.* supply-trough; *h,* space cut out of floor for escape of water.

APPARATUS USED IN FISH-CULTURE.

Labors of Commissioner Green.—Mr. Green, while awaiting legislative aid for fish culture in his own State, has volunteered his services in other sections. He gives the following account of his operations:

"On the 11th of May, 1868, I put four thousand shad-spawn, properly impregnated, into a hatching-box at Long Bridge, on the Potomac, the water being at a temperature of sixty-four degrees; on the 13th they showed signs of life, and I put in seventy thousand more. On the 14th the form of the fish was visible, and on the 17th they hatched. To draw public interest to the matter, I hatched some in a tumbler in the house of General Spinner, at Washington. They left the egg eighty-four hours after impregnation. I hatched fifteen hundred in a salt-box, with a sieve bottom, in a room in the treasury building. On the 13th of May, I had also obtained a quantity of white-perch spawn. This is of a glutinous nature, and sticks fast to brush, weeds, or grass, and can be readily transported in that condition. It hatched in about a week, with the temperature of the water at about sixty-two degrees. In the Potomac the striped bass and herring spawn May 25, the sturgeon May 20, and the catfish June 10. From that river I proceeded to the James, and continued my endeavors to interest the fishermen in propagating shad. Then I returned to New York, stopping on the Susquehanna and the Delaware, the latter a magnificent stream, where shad culture might be carried to any extent, and which might be filled with fish. On June 4, the fishermen were taking up their nets at Carmansville, and along the lower part of the Hudson, as they were only catching four or five fish a day. At Clifton I saw a shad with the spawn running from it. On the 18th I put a quantity of spawn into a box at James J. Mulls's fishery, near Coeyman's landing, and saw evidences of life in thirty-six hours, with water at seventy-seven degrees. I had much trouble in getting spawners; they can be taken only at night. Both on the Hudson and at Holyoke my experience was the same; during the day none were to be had; from 7 p. m. to 12 p. m. we could take them in proper condition, but after 12 p. m. we could only take unripe fish. This leads me to think they deposit their spawn during the day. The steamboats were troublesome, the waves that followed them washing over my boxes and carrying away the spawn. I had to locate my boxes behind the erections put in the river to deepen the channels. Very few shad are to be found above Albany; not one will be taken, on an average, at a haul, although there are several other kinds of fish more abundant. There must be an extremely small number that run the gauntlet below successfully. After I had thoroughly examined the Hudson, I proceeded to Holyoke, and continued the artificial propagation of shad until I was stopped by the hot weather. I instituted a series of experiments which showed conclusively that while shad will hatch with water at a temperature of seventy-eight degrees, the eggs will all die when the temperature rises to eighty-two degrees.

"In the fall of this year (1868) I commenced the artificial culture of white fish. I obtained a quantity of the spawn, and submitted it to various courses of treatment. My most successful plan was to manage it as I do the ova of trout—to put it in my hatching-troughs, which are twenty-four feet long, with an inclination of three inches, and which are divided by bars across, two inches high. Gravel is laid in the compartments one and a half inch deep, so that the depth of water is only half an inch. The eggs are heavy, like those of trout, and sink instantly in water. In thirteen days the fish were visible in the egg by the aid of the microscope, and in twenty-one days they exhibited signs of life, the water standing at a temperature of forty-five degrees. They hatch

more rapidly than trout, and in those which I have with me the fish are plainly visible to the naked eye. Most of those have been kept in wet moss, in which their development has progressed, although more slowly than when in their proper element. I only stripped five or six females, and obtained some two hundred thousand eggs, as they contain about ten thousand eggs to the pound of their weight. These were placed in damp moss as soon as impregnated, and carried in a buggy over country roads seven miles, then by railroad twenty-five miles the same day. They are now doing well, and bid fair to hatch as large a percentage as could be expected with a first experiment."

The Pennsylvania Commission reports a catch of 20,000 shad within a distance of fifty miles above Columbia, as the immediate result of building the fishway at that place. The dam, which is ten feet high, was cut away to three feet at the point surmounted, and an incline of forty-five feet was constructed to overcome an elevation of three feet. Dams above, the owners of which are awaiting the adjudication of courts as to their liability for the erection of fishways, shut out these fish from three hundred miles of rivers above.

The Connecticut commissioners are co-operating with those of the States lying northward, and awaiting the erection of the fishways at Holyoke and Turner's Falls. They have issued two or three interesting reports.

The State of Massachusetts has expended, during the last year, $4,000 in the artificial hatching of shad, at Holyoke, on the Connecticut. Several thousands of salmon were hatched for the Massachusetts commissioners, at Meredith Village, New Hampshire. Black bass have been introduced into several ponds, and spawn of the land-locked salmon has been procured for artificial hatching. The lake trout, smelt, and other useful fishes are about to be introduced.

Since the enactment of laws in New Hampshire for the protection and fostering of this interest, salmon have been hatched for the Merrimack and Connecticut rivers, the lake trout of lake Winnipiseogee have greatly increased, and black bass have been introduced into Sunapee, Massabesic, Pennacook, and Enfield lakes. Fishways have been built at Manchester, Laconia, Franklin, Sandbornton Bridge, and other places. The cost of the last years' operations was scarcely $1,500, and $4,000 placed at the disposal of the commissioners for expensive and burdensome fishways was not required, individuals promptly complying with legal requisitions.

Mr. C. G. Atkins, one of the Maine commissioners, writes that beginings have been made in artificial propagation of shad, and land-locked salmon in Maine. At Manchester, three thousand of the latter were hatched under his direction, as a preliminary experiment, and three thousand brook trout. Another experimental establishment at Alna was conducted successfully by Mr. David C. Pottle.

Dr. W. W. Fletcher, of Concord, New Hampshire, and Rev. Livingston Stone, of Charlestown, in the same State, have been engaged successfully in obtaining ova of the salmon from New Brunswick, for propagation, under the direction of State officials.

EXPERIMENTS OF INDIVIDUALS.

Trout works at West Bloomfield, New York.—Stephen C. Ainsworth, who may be called the pioneer of pisciculture in this country, has been nine years experimenting in hatching and rearing fish, especially trout. He writes concerning his works: "The spring which I have is very small, only filling a half-inch tube; consequently my experiments have

been on a small scale as to number of trout and spawn. In the fall of 1866 I took twenty-one thousand spawn, and hatched twenty thousand fishes. Some of them died soon after they began to eat, owing to insufficient water. The remainder I put into neighboring ponds and brooks. In 1867 I took twenty-five thousand spawn, and sold all but two thousand. All hatched but fifteen; they are now (July 29, 1868,) from one and a half to four inches long, very fat, and as tame as kittens. I hatched sixty thousand one year with this one-half inch of water, but disposed of most of them soon after. I have hatched one hundred and ninety-nine out of two hundred spawn taken from a trout, but to hatch ninety to ninety-five per cent. of all spawn taken is first-rate luck; and to grow ninety per cent. of these is doing well, although I do not think I lost one per cent. of those I hatched last spring. From my experience I am satisfied that one inch of water from forty-eight to fifty-two degrees, with proper care and fixtures, will hatch a hundred thousand trout, and grow in good health sixty thousand one year.

"Four years since I put a few trout just hatched into a spring pond in this vicinity. Last summer some were caught that weighed two pounds each. This demonstrates how rapidly they will grow in deep, cold water, with ample room, and abundant natural food.

"We have now several hundred trout ponds in this State that have been in operation from one to six years, artificially built, and stocked with this speckled tribe. From all these experiments we can safely say that the artificial propagation and cultivation of brook trout in this country is a settled and permanent fact. From these statements it is manifest that any person in possession of a spring producing a supply of water through the year of from one inch to one hundred square inches of pure water may grow, with right appurtenances and requisite knowledge and care, from six thousand to six hundred thousand trout in one year, worth, at present prices for stocking ponds and streams, a hundred dollars per thousand, or, five hundred to fifty thousand to weigh a pound each, worth one dollar per pound.

"I have grown fifteen hundred to weigh half a pound to three pounds each, with only a half-inch flow of water, though I am sorry to say that I lost about a hundred during this long, dry, heated term, and about a thousand four years ago, weighing twenty-five hundred pounds in all. With a good spring of one half-inch of water, one may raise all the trout he needs for his table, with trifling expense. A dam may be pushed across any spring brook, with a screen to prevent the fish from running over the dam; and by graveling the stream well above the pond, large numbers may be grown naturally every year."

Seth Green's trout stream and ponds.—The most noted trout-breeding enterprise is that of Seth Green, in Caledonia, Livingston County. The site of a mill stream of spring water was purchased a few years since for two thousand dollars, and ponds improvised by creating divisions in the old "forebay" and raceway. When his operations in artificial propagation had fairly commenced, he accepted a proposition for six thousand dollars for a half interest in the works. Ponds, races, hatching-houses, and hatching-boxes were subsequently constructed, and the works extended. The profits of trout propagation, under favorable circumstances, may be seen in the reported net results of this enterprise: One thousand dollars in 1866; five thousand dollars in 1867, and ten thousand dollars in 1868.

Mr. Ainsworth, writing to this Department in July, 1868, states that Mr. Green hatched, artificially, one hundred and eighty thousand trout in 1865; three hundred thousand in 1866; six hundred thousand in 1867; that in 1868 he sold three hundred to four hundred thousand

spawn for stocking ponds and streams, and hatched four hundred thousand small fry. The stream is a mile long, averaging four rods wide, and from two to six feet in depth, affording eighty barrels of water per second, ranging in temperature, through the year, from forty-three to fifty-eight degrees. The water in the spring is at forty-eight degrees. He had in the summer of 1868 nine thousand parent trout, weighing from two to four pounds each, in one pond, seventy-five by thirteen feet, and five feet deep. This pond is supplied by a stream that changes the water every minute. Another pond forty feet square had twenty thousand smaller trout, weighing from one to two pounds each. The water is so clear that all are distinctly visible. Mr. Ainsworth deems the supply of water sufficient to grow millions of trout to perfection.

The Troutdale establishment.—The fish farm of Dr. J. H. Slack, of Troutdale, near Bloomsbury, New Jersey, has ample and well-arranged apparatus for fish-hatching. It is located in the Muskametkony Valley, in Warren County, sixty-four miles northwest from New York City. The "works" cover about two acres, and are supplied by a stream of clear spring water flowing continually at the rate of a thousand gallons per minute. Summer and winter the water reaches the hatching-house at a uniform temperature of about fifty degrees Fahrenheit. The ponds contain, (June, 1868,) beside an ample stock of small fry, about seven hundred adult trout, some of them of three pounds weight. The ponds are three in number, the one nearest the hatching-house prepared for the reception of twenty thousand young trout hatched during the winter; the next assigned to the use of larger specimens not exceeding eight inches in length; the third occupied by the full-grown or well-developed trout.

The bottoms of the ponds are of clay, upon which large stones have been placed to enable the fish to free themselves from parasites, animal or vegetable, which cause great debility and mortality, unless by friction the trout can obtain speedy riddance from the troublesome visitors. Large floats, made fast to the banks by wires, afford a grateful and necessary shade. The bottoms of the races are covered with small stones and a layer of fine gravel, and the sides are slated to prevent crumbling of the banks.

The accompanying illustrations represent the Troutdale fish-ponds and hatching house. Dr. Slack regards pisciculture as no longer an experiment, but as a pursuit quite as certain as agriculture, and at present much more profitable. He describes the process of taking and hatching the eggs. The spawning season, commencing about the middle of October, was indicated by the changing of the bright tints of the female to a sombre hue, the anterior projection of the lower jaw, the distension of her abdomen by the ova, and uneasy movements in seeking suitable gravel beds for the deposition of the spawn. On October 30, fishes were seen in the race busily engaged in forming their nests, by removing the fine gravel from a circle a foot in diameter. Specimens were then taken, and the ova expressed and fertilized in the usual manner. He proceeds:

"After being thus secured the eggs were taken to the hatching-house, which had been made ready for their reception in the following manner: The hatching-trough had been filled to the depth of two inches, with fine gravel, carefully boiled to destroy the eggs of any insects which might have been present; over this a gentle stream of water from the spring, filtered through four screens of fine flannel, was conducted. Upon the gravel the eggs were placed, the greatest care being taken to avoid any sudden jar, as the recently impregnated egg requires the most gentle handling lest suddenly acquired life be as suddenly extinguished. After resting on their new location for a few minutes they were evenly spread

PLATE XI.

Troutdale fish ponds.

Troutdale hatching house.

TROUTDALE FISH PONDS AND HATCHING HOUSE

over the bottoms of the troughs by means of a fine feather. During the entire process the eggs had not for an instant been exposed to the atmosphere.

"This process of impregnating and depositing in the hatching-house was repeated semi-daily until January 12, 1868, during which period about seventy-five thousand eggs were taken. Experience shows that from a trout of one pound about one thousand eggs is the average yield; but owing to causes entirely beyond the control of the proprietor, only twenty thousand hatched. The dead eggs were removed daily, being readily distinguished by turning snow-white; these still retaining their vitality resembled small pearls, being translucent and slightly clouded. The first young appeared December 10, forty days after the impregnation of the eggs."

Fish-breeding works at Meredith Village, New Hampshire.—The trout and salmon nurseries and general fish-breeding works of Hoyt & Robinson, at Meredith Village, New Hampshire, present a good example of what may be done in pisciculture with a small but constant stream of uniformly cold water, in a location properly situated. The spring supplying the water gushes in a bold stream from the base of a sharp declivity at the head of a narrow ravine, and is the source of a well-known trout brook, less than a mile in length, discharging into Lake Winnipiseogee.

The ponds are so small and yet so populous with thousands of trout and salmon, that they may well serve to illustrate the wonderful facility with which these fish may be reared, in suitable water, with some attention and feeding. The accompanying wood-cut shows the relative size and form of the ravine itself, the ponds, raceway, &c. The first pond, about the size of a city house-lot, twenty-three by one hundred feet, contains thousands of trout from one to two years old, which, as seen by the writer, sporting in water so clear that every one was visible, and crowding one another in their graceful and constant movements, presented a scene of natural grace and beauty rarely equalled.

The temperature of the water is forty-eight degrees in summer, and forty-five degrees in winter, and the uniformity of temperature is no less remarkable than the purity of the water.

The lowest of the three ponds, which is the largest and deepest, is occupied by the fish of three or four years, weighing from one to three pounds. At a recent inspection, a small dip-net, at a single sweep, while the speckled beauties were competing for an award of minced liver, was seen to rise half filled with a struggling mass of well-grown trout. From this pond a fishway (as shown in the illustration) leads to the brook below, by which many wild trout ascend and fall into a box, from which they are taken and added to the general stock.

Just below the hatching-house, between the first and second ponds, a raceway is adapted to the uses of a fish nursery, and Mr. Robinson has contrived a feeding apparatus which consists of a box, or miniature raceway, in the bottom of which slits of three or four inches in length are cut obliquely through at intervals of a few feet; and through these apertures the food is distributed by a gentle stream of water which is kept constantly flowing through the box. It is curious to observe the young fry, as they frequent the space beneath these apertures, and seize upon every atom of food which falls into the water: even cleaning away the sand and gravel which covers the bottom of the raceway in their competition, in which they imitate the greed and voracity of pigs feeding at a common trough.

Another feature of their establishment is the preparation of artificial

spawning beds, in which the trout may deposit their ova naturally. They consist of a series of screens, the lower one with very fine meshes, the upper with coarser ones covered with clean gravel or small stones. Upon the latter the parent fish make their nests in the spawning season, the female expressing the ova, and the male throwing the milt, just as they are accustomed to work in the natural stream; and the fertilized spawn, falling through the first screen, rests securely upon the second or lower, which is removed to the hatching-house to be watched and waited upon until the hour of hatching arrives.

In 1867 there were hatched here, 10,000 brook trout, 40,000 lake trout, and 5,000 salmon; in 1868, (hatched or eggs sold,) 100,000 brook trout and 46,000 salmon. There are now 20,000 breeding trout in the ponds, from which 1,000,000 small-fry are expected another season.

Trout breeding at Nashua, New Hampshire.—An experiment in the artificial propagation of the trout was undertaken in 1867, by Messrs. George Stark, Edward Spaulding, Charles Williams, and O. H. Phillips, in the interest of practical pisciculture, and with the hope of cheapening a desirable luxury. The location is peculiar. A marshy area of three or four acres is nearly surrounded by an ampitheatre of high hills, from the base of which issue numerous springs of clear cold water, which varies little in temperature during the year, and less, perhaps, in quantity of water discharged in different seasons. These springs, uniting, form a brook of sufficient volume to support naturally a goodly number of the finny inhabitants, and a decided reputation as a trout stream, though it is little more than half a mile from its hundred heads to its single mouth, where it embouches into the Nashua.

A dam, three or four feet in height, was thrown across the ravine, and a pond of an acre and a half obtained, five or six feet deep at points of least elevation, but quite shallow in a large portion of its area, and interspersed with growing trees and shrubs and ferns and other forms of vegetation. So equable is the temperature of the water that there is noted a difference of only eight degrees; fifty degrees being the record in summer and forty-two degrees in winter. In this pond were placed five hundred trout; a hatching-house was erected just below, and ten thousand eggs were procured from Seth Green, and placed in the hatching-boxes for the first experiment in November, 1867. The water, before entering the boxes, was filtered through six flannel strainers, (which were washed nearly every day,) and every foreign substance and every decaying egg was removed. The result was successful beyond the expectation of the amateur fish-hatchers. In March, nine thousand small fry appeared, or ninety per cent., from ova brought more than four hundred miles.

While the eggs were being placed in the hatching-boxes, the full-grown trout in the pond above were seeking suitable spawning beds in shoal water in which they deposited their eggs, which were duly fertilized and left to hatch naturally. Early in the season large numbers were observed just from the egg, brisk and vigorous, the yolk sac unabsorbed, and growing to two or three inches in length by the following August. The older trout, fed two or three times a week with fresh liver, appeared to have doubled in weight during the year.

The experiment warranted larger resources, and in 1868 a more spacious house was built, capable of hatching one hundred thousand in a single season. Small tanks or ponds adjacent to the hatching-house are excavated for rearing the small fry, or for keeping the spawners while ripening, by digging away a foot or two of bog earth at the base of the

PLATE XII.

Hatching house, nursery, and pond.

Third or lower pond and fishway.

MEREDITH VILLAGE FISH BREEDING WORKS.

hills, exposing a bed of fine gray sand, in which living springs bubble up continually, and fill the excavation with clear cool water.

It is proposed to increase the height of the dam five or six feet, and obtain a pond of three or four acres. Another pond, below the hatching-house is also filled with trout. When the full capacity of the works is employed, it is believed that some hundreds of thousands of the beautiful *Salmo fontinalis* may be sporting together within their waters.

Cold Spring trout works at Charlestown, New Hampshire.—Rev. Livingstone Stone has a nursery of brook trout at Charlestown, near the Connecticut, where he has also been experimenting with salmon. He received a portion of the seventy thousand eggs obtained from the Mirimichi, in New Brunswick, a year ago, the remainder going to the hatching-boxes of J. S. Robinson, of Meredith Village, toward the restocking of the Merrimack River. Mr. Stone has since obtained, after encountering opposition and hinderance from the authorities of New Brunswick, two hundred and fifty thousand eggs from forty salmon, half of which were left, by stipulation, to be hatched in their native stream, and half were distributed among the pisciculturists of Massachusetts and New Hampshire, for the stocking of the Connecticut, Merrimack, Salmon Falls, and other rivers of these States. The parent salmon weighed from ten to thirty pounds. The largest number of eggs taken from a single fish was estimated at twenty thousand; the eggs packed in baskets of wet moss, and conveyed one hundred and twenty miles on sleds, three hundred and twenty by rail, and two hundred and eighty by water. At Cold Spring there are about one hundred and fifty thousand trout hatched, (one hundred and sixty thousand eggs,) and an extensive salmon nursery is in full operation.

Long Island trout ponds.—Experimental and initiatory practice in trout-rearing is becoming common upon Long Island. An investment of three hundred thousand dollars, as is reported, has already been made. Returns have of course been light as yet, except in the sale of eggs and young fish.

A few of these improvements may be mentioned. The Sportsman's Club consists of one hundred members; entrance fee, five hundred dollars; yearly dues, twenty dollars. Its property, (at Islip,) sixty to seventy acres, with natural streams, improved by art, exceeds fifty thousand dollars in value, and is yearly increasing in pecuniary and piscatory value. It is at Smithtown, on the north side of the island.

The "Stump Pond," owned by Phillips & Vales, is fished by the "Walton Club." The property covers two hundred acres. Perch and other intruders reduce the value of the property as a trout preserve.

Near this property is one of the best improvements on Long Island; Maitland's Pond, costing thirty thousand dollars, including forty acres of land. A costly lesson in fish-culture was taken by the proprietor, in failing at first to drain off the stream and expel the burrowing pike and eels, which fed to satiety upon the young trout, and to remove the mud and slime of the bottom.

A fine stream, ten miles west of that of the Sportsman's Club, owned by Stillingworth and Johnson, has been improved, and is valued, with two hundred acres of land, at thirty thousand dollars.

At South Oysterbay is a fine trout pond, the property of Timothy Carman, valued at fifteen thousand dollars. The most approved methods of practical pisciculture have been adopted in fitting up a preserve upon the property of August Belmont, as also upon the Phelps property, and a dozen or more other improvements, valued at five to ten thousand dollars each, have been made between Jamaica and Islip.

A very complete establishment is that of Mr. Furman, at Maspeth. The stream, passing through a marshy tract, was small and sluggish, and the experiment of extending it in curves like the letter S through a course of half a mile was deemed a doubtful one: but pure springs came bubbling up from the sand below the excavated earth: the bottom was covered with washed gravel and pebbles, and the sides lined to prevent the washing in of mud. A dam shuts off the surface water, and the improvements of ponds, spawning grounds, and nurseries are very extensive and complete.

Successful experiments in lower latitudes.—The black bass, (*Grystes fasciatus*,) ranking little below the brook trout as a game fish, and surpassed by few species in quality and flavor, was a few years since unknown in the Potomac, but is now found in moderate abundance in the markets of Washington. Two sportsmen have killed in a few hours of a summer day, a short distance above this city, with the red ibis fly, eighty pounds of this fine fish. It is said that these waters were supplied with black bass as a result of the introduction of a dozen or more, which had been brought from the West in a locomotive tank, by a Mr. Stabler, and thrown into the Potomac at Cumberland, Maryland. The increase in this river has been rapid, and is indicative of what may be accomplished in stocking eastern rivers with new species of fish, as well as replenishing them with old kinds.

The facility with which the brook trout can be propagated in situations having a constant supply of spring water is well illustrated by an experiment made in Pennsylvania, and reported by the editor of the Turf, Field, and Farm, in which twelve hundred trout, weighing one-fourth of a pound each, were bred in a large horse-trough at a country tavern and fed upon offal from the kitchen and curds from the dairy.

In the States west of the Alleghanies less attention has been given to the subject, the population of that great section not having crowded upon subsistence as yet, and the lakes and rivers not yet giving signs of exhaustion. Here and there a gentleman has a small trout preserve upon his own premises, as a matter of taste and luxury.

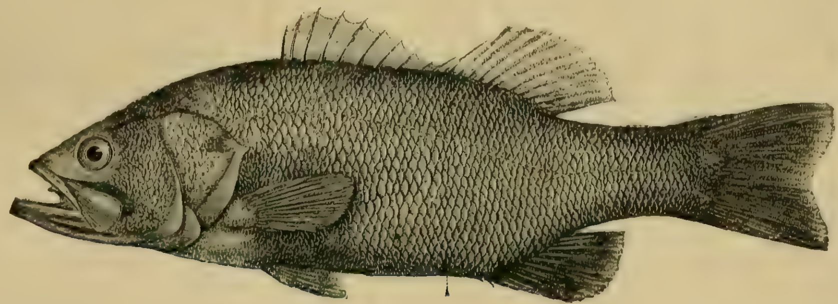
A few cases of more extensive effort are reported. A Mr. James Campbell, of Washington County, Indiana, has four trout ponds, in which he has, as is claimed, ten thousand fine speckled trout weighing a pound each.

OYSTER CULTURE.

The culture of oysters in this country, though mainly confined to their planting and fattening in sheltered beds, somewhat similar to the French *claires*, or fattening beds, is destined to be greatly extended, especially in the direction of breeding them by artificial aids and appliances. The efforts of ostreoculturists may be stimulated by a view of this branch of French industry, condensed from the London Technologist:

"The very latest novelty in French oyster culture is the introduction by Mlle. Sarah Felix, the sister of the late Madame Rachel, of the American horse-shoe oyster. This lady is an enthusiastic ostreoculturist, and she has a suite of parks near Havre, which are said to be very profitable. Many of Mlle. Felix's countrymen have of late years taken to oyster farming, and in a short time the foreshores of France will be crowded with oyster-beds, when one of the greatest industries of that country will assuredly be the breeding and fattening of that popular shell-fish. The expense of rearing oysters is so trifling, and the returns so large, that thousands of the seafaring people have gone into the business, and many

PLATE XIII.



BLACK BASS—MICROPTEROUS ACHIGAN, (GRYSTES FASCIATUS.)

of the inland vine-growers and general farmers have removed to the coast in order to try their luck at this new industry. There is a great demand for the oyster in all parts of France, and as the mollusk may be kept out of the water for a few days without any harm, or can be kept in tanks and be artificially fed till such time as it is wanted for table purposes, a number of fishermen, who could not find an outlet for either their round or flat fish in consequence of the rapid transit required to insure their fish being fresh on arrival at the market, have, within a year or two, taken to the rearing and fattening of oysters. There are few places now on the shores of France where oyster culture is not carried on in some of its varied phases. There are either *viviers* for keeping them alive till called for; parks for breeding them in; *claires* for fattening them, or pits for greening them. And the French government, with a view to promote so laudable an industry, has established model beds on various parts of the coast, in order to teach practically the art of oyster farming. As well as being useful in a commercial sense, these model beds have been of great use to M. Coste and other French naturalists, by allowing them to determine the exact age at which the oyster becomes reproductive, without which knowledge no animal, sea or land, can be profitably bred. The French park system also admits of the proper study of the spat mystery, which is now attracting the gravest attention of all interested in the natural and economic history of the oyster. As an example of the spat difficulty, it may be mentioned, that while in the basin of Arcachon, the spat has never been known to fail, yet around the Ile de Ré the fall for these some years back has been very intermittent, as it has also been on the English beds. In the sheltered basin of Arcachon the plentiful spatting may be accounted for on the principle that the spat has nowhere else to go—it must fall within the basin. In an open expanse of sea it is different; the spat may be carried away to great distances by tidal influences, or a sharp breeze upon the water may waft the oyster seed away for many a long mile. Every bed has its own time for spatting; thus, one division of the Ré beds may be spatting on a fine warm day, when the sea is like glass, so that the spat cannot fail to fall; while on another portion of the island the spat may fall on a windy day, and be thus left to the tender mercy of a fiercely receding tide, and so be lost, or fall, mayhap, on inaccessible rocks, a long way from the shore. On the Isle of Oleron, which supplies the green oyster breeders of Marennes with such large quantities, it is quite certain that in the course of the summer a friendly wave will waft large quantities of spat into the artificial parks, when it is known that the oysters in these parks have not spawned.

The difference between French and English oyster farming is not much, but the little that there is, is of great importance in the economy of an oyster farm. The endeavor of the French is to obtain spat or brood without purchase. Hitherto this has not been the case in England; the dredgemen are but too willing to pay for brood when it can be obtained, but of late years, in consequence of a paucity of spat, it has become scarce and ill to get. The new oyster farms which have been laid down in England of late years are all upon the French plan, and already we are hearing of their success, spat having fallen upon some of them in great plenty. In the Firth of Forth oyster beds, no pains are taken to protect the oyster; the grounds are never overhauled or "worked;" the brood is sold by the hogshead to all and sundry who will come and buy it; the result, as may be expected, is that in Edinburgh oysters are scarce, small in size, and dear. While the men of Whitstable have become rich by their thrift, the men of Newhaven have become

poor from consenting to the spoliation of their oyster beds, which are naturally the finest in the world. They have at length killed the goose for the sake of the golden egg.

Any attempt to find out the figures pertaining to the annual oyster commerce of France is generally abortive. No one knows exactly what these figures are, but, of course, every man forms his own opinion. An oyster merchant of Rochelle, doing business with the growers of the adjacent islands of Oleron and Ré, will say £250,000 per annum, while a Bordeaux skipper, with large ideas, will give figures representing four times that sum. It is unquestionable that there is an immense oyster business done in France. Paris alone requires at present a daily supply that, in the course of the season, is said to amount to a hundred millions, and the large provincial towns all consume in proportion. Countless numbers are, besides, exported, cured, prepared, and pickled. Official figures state that in 1862 the three factors appointed by the government for the sale of oysters in the grand market disposed of 67,836,909, being an increase of twelve and a half millions on the preceding year. We are constantly coming across paragraphs in the provincial newspapers of France about the oyster trade. Lately the Phare de la Manche told us that Paris now requires ten times as many oysters as in 1856, and that they are now double the price; further, that six thousand women get a living during the oyster season in opening oysters alone. The same paper also gave us the astonishing intelligence that *huîtres de la Manche* were the most esteemed in Paris; that the green oysters of Marennes are not now in demand, except for exportation, and that the Ostend pitted oysters had taken their place. It is certain that Ostend furnishes to Paris about three million oysters per annum; there are official figures to that effect. There has been also published a cluster of reliable figures about the oyster grounds of Arcachon, in which it is stated that the oyster grounds of the basin, including the royal parks on either side of the bank of La Hillon, occupy space to the extent of twelve hundred acres. A stock of over two millions of breeding oysters was laid down in the royal grounds, and there yielded an enormous amount of spat. A portion of the two millions, viz., five hundred thousand, laid down in 1863, is said to have yielded young to the extent of seven millions! If this statement be correct as to a fortieth part of the mother stock, what would the total yield be? It would, in fact, be too enormous for figures to express it.

Everybody has heard about the immense fecundity of the oyster, and to yield such supplies as are indicated by the above figures the animal would require to be very prolific. The writer has seen a little branch, taken from an artificial bed, which contained a few thousands, and he has seen many common tiles with hundreds of oysters on each. The Whitstable of France is on the Ile de Ré, where may be seen a few thousand oyster *parcs* and also a few hundred *claires*, or fattening ponds, and hundreds of thousands of oysters in all stages of growth, from the size of a pin's head to a crown piece. One of the many difficulties which the French oyster-growers have had to solve is the construction of a proper medium for the reception of the spat. Every kind of material has been tried—branches of trees, logs of wood, fragments of rock, and now tiles made of clay are being extensively used, and with the greatest possible success. At Arcachon a hive of an ingenious kind, that is, a suite of small boxes filled with gravel, and contained in a larger box, was tried, and was found to suit very well. The best of all bottoms could be constructed in the *parcs* by the filling into them of the numerous shell middens that are to be found in some of the fishing places. The formation

PLATE XIV.

Fig. 1.

Oyster house at Christfield, Maryland.

Fig. 2.

Opening oysters.

OYSTER HOUSES.

of new *parcs* and *claires* still goes on at the French seaboard, new concessions of ground for that purpose being frequently made, and a tour to most of the fishing places gives the idea of the future wealth to be obtained from this source, more especially when the natural and economic history of the oyster comes to be more thoroughly known.

We are indebted to W. C. Lodge, of Delaware, for facts concerning

OYSTERS OF THE CHESAPEAKE—THEIR PROPAGATION AND CULTURE.

Oysters are found in most of the saline waters of the world, where tides flow and ebb, except in the extremes of temperature, but they attain a condition of perfection, as regards size and quality, only in the waters of temperate and semi-tropical climates.

Natural beds of oysters exist in moderately deep water, generally from seven to thirty feet, according to the climate, the character of the bottom, and other conditions favorable or otherwise for breeding, and the growth and preservation of the young. They are located near the coast, at the mouths of rivers, or in the semi-fresh waters of the bays. Natural beds exist in isolated patches or clusters of indefinite extent and varied thickness. Those on the coast are found in indentations or sheltered localities, as the exposed portions of the ocean are subject to such agitations from violent winds, that the sand or mud of the bottoms is disturbed to such a degree as sometimes to cover the oysters. This is destructive to the young, and even old and perfectly grown oysters will eventually perish when covered by sand or mud. The more tranquil the water, other things being equal, the more prolific and flourishing the beds.

Oysters, as regards both growth and quality, are influenced by the condition of the water in which they exist. Those on the Atlantic coast, in the unmitigated salt of the ocean waters, are small and too salt for use, while in the neighboring bays and at the mouths of the rivers, where the out-going fresh water mingles with that of the sea, the oyster attains its greatest size and best flavor.

The Chesapeake Bay and its tributaries afford the most favorable conditions for the natural growth of the oyster, as well as all needful facilities for its artificial propagation and culture. Located in the proper temperature, its bottoms of sand and rock, its abundant produce of sea-moss as a home and breeding place, its waters tempered in degrees of saltness to suit all varieties, and its numerous fresh-water streams, bringing down in their floods a continuous supply of food and other requirements, render the bay superior, in its oyster grounds, to any body of water on this continent or perhaps in the world.

From Kent Island, within twenty-five miles of Baltimore, to Cape Henry, a distance of one hundred and forty miles, the bottom of the bay is, with slight exceptions, a continuous oyster bed. All the fresh-water streams that empty into the bay within the above-named limits are stocked, either naturally or artificially, with oysters, as far up toward their sources as the influence of the salt water extends.

Area of the oyster beds.—The area of the oyster beds of the Chesapeake and its tributaries may be safely estimated at three thousand square miles. There is, however, great inequality in the quantity of bivalves scattered over the bottoms. In some places they are so few as to render fishing for them unremunerative, though such are exceptions rather than the general rule; while, in other portions of the bay, they increase so rapidly, that many perish from the weight by suffocation or for want of food.

The oyster business.—Some idea of the magnitude of the oyster business of the Chesapeake may be obtained from the reports of the oyster commission, created by the State of Virginia and of Maryland.

The bay is divided into two departments, and each has its proper police regulations. The Baltimore department, which includes less than one-half the oyster fisheries, reports an annual average of eleven million bushels, taken in the legitimate way of dredging and tonging. The reports of both departments aggregate from twenty million to twenty-five million bushels, which are only an approximation to the quantity actually taken. This report does not include the oysters taken from private beds or plantations, owned by the residents on the islands and the shores of the bay and rivers, who do not regularly engage in the trade, but cultivate them for their own uses; nor the numbers taken by the half-piratical "pongys," canoes, (Fig. 3.) and other small craft that continually depredate upon the beds without the required license.

In the city of Baltimore seventy houses are engaged in the oyster business, mostly in canning for exportation, while at various points in the bay are establishments (Fig. 1) that employ from fifty to four hundred hands each, during the season, in opening and canning, (Fig. 2.)

By the official reports there are fifteen thousand persons engaged in the business of oyster fishing, (Fig. 4,) and a fleet of one thousand seven hundred vessels of fifty tons burden, and over three thousand smaller crafts, are duly licensed for the trade.

Besides the regular transactions that come under the cognizance of the commission, there are numbers of men and vessels employed in procuring "plants" from various places abroad for the artificial beds, and there is a population of 20,000 persons, on the islands and mainland, with whom oysters form an article of general consumption throughout the season.

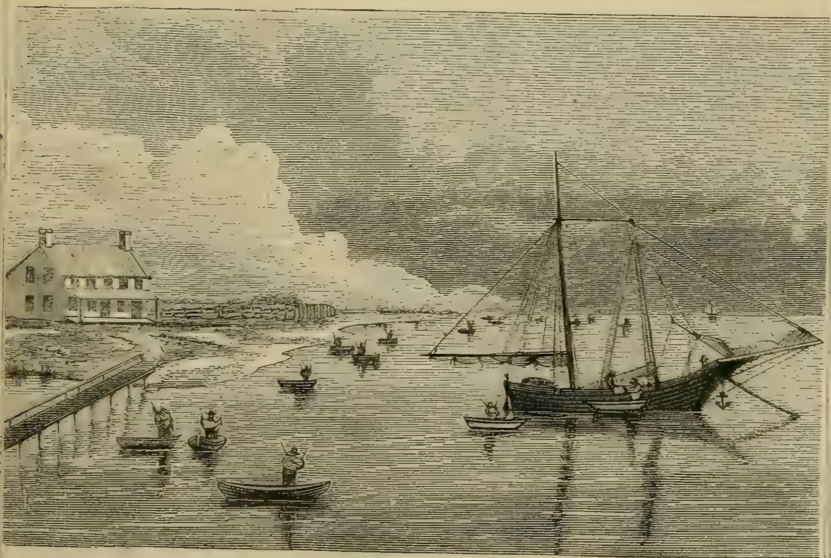
Oyster fishing.—The implements used in oyster fishing are few and simple in construction. They are the dredge, the tongs, and the fork (Fig. 5.) The dredge is used on the natural beds, in deep water. It is an iron net set in pear-shaped iron frames, and furnished with teeth so arranged as to tear the oysters from the beds, and gather them into the net as it is drawn over the bottom by the vessel, to which it is attached by means of a long rope. It weighs about one hundred and fifty pounds, and is drawn on board the vessel by a windlass arranged for the purpose. It is designed to hold about three bushels, though it is rarely filled with marketable oysters at one "haul." When one-fourth of the contents is good oysters, the "haul" is considered a good one. The remaining empty shells are cast back into the water. The tongs are composed of two iron rakes attached to long wooden poles, with an axle set near the rakes. The fisher leans over the side of his boat, and handles this tool with ease in water from two to eight feet deep (Fig. 4.) It is used chiefly on planted beds. The fork is composed of ten or twelve tines, or prongs, set near one another, and fixed to a long, stout handle. It is used for fishing in shallow water, on beds where oysters are entangled in sea-moss, and the fisher generally wades in the water in order to manage it easily.

The plants and planting grounds.—The plants are gathered in the months of August, September, and October, chiefly along the Atlantic coast, particularly on the coast of the Carolinas, where exist prolific beds of oysters too salt for general use. In their native beds these oysters do not attain any considerable size, but transported into the semi-fresh waters of the Chesapeake, they grow rapidly, fatten, and become more fresh and consequently edible. The plants measure from

Fig 3.

Pongy and canoe.

Fig. 4.



Oyster fishing at Cherrystone Virginia.

OYSTER FISHING.

one inch to three inches in length, and, when planted in the best feeding grounds, grow in a year to four or five inches, when they are regarded as marketable.

The best planting grounds, all things considered, are found in Tangiers Sound, a portion of the bay opposite the county of Dorchester, and of Somerset, in Maryland, and marked off from the bay proper by a chain of islands dropped from the Dorchester Hook to Crisfield, the present terminus of the Delaware railroad. Here the water is comparatively shallow, and the sound is so completely shielded by islands on one side, and the mainland on the other, as to be at all times tranquil. The business of planting, therefore, may be carried on without interruption, and the plants are not liable to be covered by sand.

Good planting grounds are valuable, and are seldom sold; but sometimes they are leased at rates ranging from $50 to $400 annually per acre. Sales of lots covered by three to seven feet of water have been made at upward of $1,000 per acre; and the most desirable grounds are valued at rates above these figures, and pay an interest of more than twenty per cent. on that valuation.

There are other excellent planting grounds superior even, in some respects, to those of Tangiers, but they are open to the objection of loss from shifting sands, so destructive to the plants. On the Tangiers bottoms exists a rank vegetable growth called sea-moss, in which the oysters become securely imbedded, and which protects the spawn and the young oysters until their shells become sufficiently hard to afford protection from the numerous anquatic foes that prey upon them.

The boundaries of the planting lots are determined from stakes or small evergreen trees, firmly secured in the mud at the corners. These fragile corner-marks are strictly respected by the neighbors, and a case of trespass rarely occurs.

The plants are allowed to remain from three to six months, never exceeding a year. The tonging season commences in September and continues through the following April, it being a rule with the fishers to close operations before May; as, according to their belief, oysters are unfit for use in any month that is not spelled with the letter R. The breeding season occupies the four months from May to August inclusive, and the oysters are then necessarily not in good condition for use. Consequently those engaged in the business during the other part of the year employ their boats in freighting fruits and vegetables, or turn their attention to trucking, particularly to the cultivation of sweet potatoes and melons, for which the islands and high mainlands are peculiarly adapted.

Quality.—There is a great difference in the quality of oysters of the same size and age. Locality has its influence to such a degree that most natural beds and all planting grounds produce oysters of different flavors. An experienced oyster fisher can, at sight, generally tell the locality from which the oyster was taken; and the epicure, accustomed to the different flavors, can by taste designate the bed on which the oyster was grown and fatted.

The oysters of Tangiers are excelled in delicious flavor by those at the mouth of the Cherrystone River, on the coast, and by those in Lynnhaven Bay on the west side, at the mouth of the James and the Nansemond Rivers. The Cherrystones deservedly hold the first rank, but are practically little known beyond their own neighborhood, as the natural beds are of small extent and their production limited. There are, however, fine feeding grounds in the vicinity of Cherrystone, and all oysters planted there become of superior quality, and are sold abroad as Cherrystones.

The true Cherrystone, in fine condition, retains its shape when cooked, (which is that of a cherry seed,) and cuts as finely as a tender sirloin.

Propagation.—The art of breeding the oyster crop, by artificial means, is still in a primitive state in this country. In France, where labor is cheap and abundant, the cultivation of the oyster crop has been carried to the same perfection that has been attained in pisciculture. There the beds are as methodically marked out as for a flower garden, and a close calculation is made as to the greatest profitable produce from a given number of plants. As a portion of the crop becomes sufficiently matured for market, it is gathered, and other plants are at once put in the place.

In the Chesapeake the plants are shoveled from the deck of the vessel as she is towed slowly over the space marked out, and the quantity is consequently indefinite. The design is, however, to cover the bottom with a single layer of the plants. The water on artificial beds varies in depth from two to twelve feet, three to four feet being most desirable, as the beds may then be inspected from the surface, when the water is clear and tranquil. Such a depth, too, is most favorable for forking and tonging, and the entire crop may be gathered at one time.

Until a comparatively recent period the oyster was regarded as hermaphrodite, but the sexes are so marked that those familiar with them can readily distinguish them at sight, the females being in excess of the males. During the breeding season the oyster is said to be "in the milk," which term is applied to the ova, or spawn. The spawn is discharged in minute, viscid balls, of such gravity that they float midway between surface and bottom in the water, and are there met by the sperm of the male, which is discharged at the same time. Fertilization is thus effected in the water, and the ova adhere to the first hard or rough substance with which they come in contact, and at once begin to assume shape, and to exhibit indications of life. The spat at first appears to belong to the vegetable rather than to the animal kingdom; but, as it continues to grow in size, the animal assumes a more vigorous and decided character. In a few weeks it is capable of a feeble, independent motion that gradually increases until the shells are perfectly formed, when it attains the power to open and close them.

The object to which the floating spawn is most likely to fasten is the shell of another old oyster, and this accounts for the fact that, while single oysters only are found in the artificial beds, they exist in clusters in the natural beds (Figure 7.)

The spawn gradually changes its rotund shape, and spreads upon the substance to which it adheres, forming a white spot that in time assumes the appearance of a thin, flat shell, though it remains soft and friable. It is now called a spat, and is covered by a delicate skin that grows thicker and harder until it becomes a shell. The spat is much sought after by fishes, crabs, and turtles, and numbers are thus destroyed. The shell begins to harden when the spat attains half an inch to an inch in diameter, and thickens with the growth of the oyster. At one year old it is an inch to an inch and a half in diameter, and its shell is sufficiently hard to place it out of danger from most of its enemies. It may now be used as a plant, though greater size and more age are desirable for stocking artificial beds.

Although ranked by naturalists in a very low scale of animal existence, the oyster is not without certain physical power, and sufficient instinct for self-preservation under ordinary circumstances, as illustrated in instances where the floating spawn has attached to the inside of the shell of an old oyster while open for feeding. Were the spat allowed to remain there, it would soon so increase in size as to cause serious incon-

PLATE XVI.

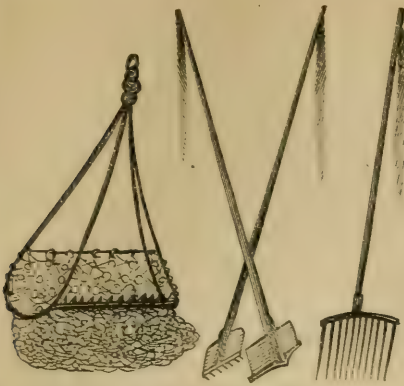


Fig. 5.—Oyster fishing implements.

Fig. 6.—Ancient oyster shell.

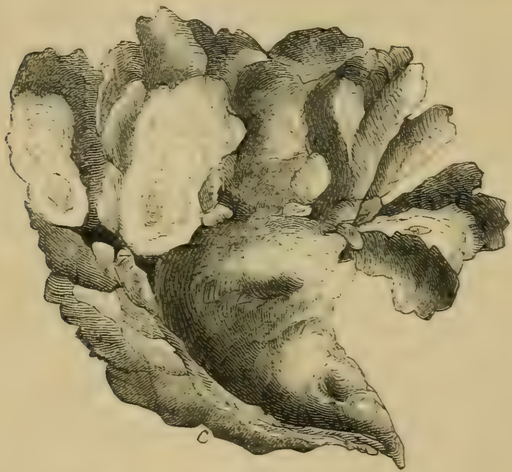


Fig. 7.—Young oysters attached to an old oyster.

Fig. 8.—Young oysters attached to various objects.

OYSTERS AND FISHING IMPLEMENTS.

venience to the old oyster, and eventually destroy its life. But, as soon as it attaches in dangerous proximity to the mouth of the shell, the old oyster works it or blows it from its position, and it finds another object, as in figure 8, which represents oysters attached to a neck of a glass bottle, and to a handle, and also a fragment of a jug; or it fastens to another place on the same shell. It is no uncommon occurrence to find in the natural beds large central oysters literally encrusted with those of smaller size, so arranged as to demonstrate the foregoing fact.

From the great prolificacy of the female oyster, it might readily be inferred that the increase would far exceed the demands, great as they are, upon the natural beds. A single female oyster contains about two million ova, all of which, under favorable circumstances, should develop into perfect oysters. But in deep water most circumstances are unfavorable to the existence of the ova and spat. They are beset by enemies and casualties from the spawn until the shells of the young become sufficiently formed and hardened to afford protection.

In the Chesapeake, as in all the oyster waters of this country, the increase is altogether from the natural beds, where the ova and young cannot be protected. In the deep water the temperature is often too cold for the development of the ova, and even when developed many of the delicate spats perish. Planted oysters are not allowed to remain undisturbed a sufficient length of time to enable them to breed. In the most favorable breeding localities, as in Tangiers Sound, the beds grow to such thickness that the underlying oyters are destroyed by the superincumbent weight of the accumulations. Here the beds are two feet and upward in thickness, with only a few inches of the upper portion composed of those living. Oysters will not survive for any long time when covered with sand, mud, or any other matter; and sometimes, by a change of current, or from disturbance of the bottom by violent storms, extensive natural beds are covered by sand and destroyed. The young oysters, when they accumulate so rapidly as is the case in Tangiers, add a stratum yearly to the natural beds, and destroy a corresponding stratum underneath. The increase is, therefore, only in the extension of the area occupied by the beds. Here dredging has been found most beneficial, as the dredge relieves the beds of their weight, and spreads the oysters over the bottom. A half century since, the bottom of the Chesapeake was interspersed with numerous isolated beds of small extent and great thickness, but dredging has so scattered them that they now form almost a continuous bed, covering the whole bottom. Dredging also clears the upper portions of the beds of the accumulations of mud and sand. The ova adhere best to clean objects, and the dirt destroys the delicate spat.

Varieties.—Notwithstanding the proximity of the different varieties of the oyster, each preserves its identity, and they remain as it were in separate families. The number of varieties found in the Chesapeake has not been precisely ascertained, but it is supposed to be about thirty. Some of them have been imported from the Atlantic coast, and others from the southern rivers as plants, but most of them are indigenous. Those in the deep waters of the bay differ from such as are on the shoals, and the same variety is not frequently found in two rivers, however near their entrance into the bay. Nature has provided thick, hard shells, capable of affording perfect security from their numerous enemies, for those in deep water; while, in the small and comparatively shallow rivers, where their foes do not exist in such numbers, the shells are thin and easily broken.

In the deposits of crustacea and acephala, forming a great portion of the marl beds in the vicinity of the Chesapeake, there are many varieties

of the oyster and clam that have existed in its waters in some unknown period of the past, but which are now extinct. Oyster shells measuring fourteen inches in length. (Fig. 6.) and clam shells one and a half inch thick and six or seven inches in breadth, are found in a state of perfect preservation.

More recent banks or deposits of shells found on the shores of the bay in the county of Talbot and of Dorchester, in Maryland, show but little difference in size or conformation from those existing at the present time. Here are banks of shells one foot to four feet thick, extending indefinitely into the mainland, and covered by soil to such a depth as to admit of cultivation.

Food.—From the investigations of scientific men nothing certain is learned as regards the peculiar food of the oyster. The regular oyster-men, who observe them at all seasons and in all conditions, entertain no other idea on the subject than that they feed upon the salt water. Certain it is that they feed only on the flood of the tide, as their shells are then open, while they are closed during the ebb. That they do eat or swallow and digest their food is inferred from their internal construction, as nature has provided them with the full complement of organs adapted to the purpose. Evidence that other food than that derived simply from salt water is consumed, is furnished in the fact that they grow and fatten near the land, in shallow water better than in the open sea, and become more perfect in size and condition in the mouths of the rivers, the floods of which carry down the elements of growth and thrift.

Artificial breeding.—With all these natural advantages afforded by the Chesapeake for the successful propagation and culture of the oyster crop, the business is not efficiently managed by the unscientific men who are, at present, engaged in the work. Were the operations conducted with skill and judgment, the profits would be greatly enlarged, and the annual product could be almost indefinitely multiplied. The artificial propagation and culture of oysters are not attended by the risks and expenses of pisciculture, and require less skill and attention to insure success; yet streams heretofore tenantless of fish are now well stocked artificially with the finest and most delicious of the finny tribe. Oyster planting is here conducted in a slovenly and wasteful manner, while new plantations are seldom made from the spawn or the young oysters. The plan here adopted for the formation of new beds is to fasten in the natural beds, previous to the breeding season, a few stakes with brush attached. The spawn will attach to these in considerable numbers, and, when the ova are developed to the proper condition, the stakes are withdrawn, and fixed in the bottoms where it is intended to form new plantations or beds. In the third year from the spawn the new plantation begins to breed, and after that period it rapidly multiplies when the conditions are favorable.

M. Costé, a scientific gentleman and eminent naturalist of France, who has made the study of the oyster a specialty, proposes to stock the whole available coast of France with oysters, at a cost of about six dollars per acre. He has invented a small, portable machine, which he sinks in the natural beds previous to the breeding season, and leaves it to become freighted with the ova, and these to be developed into young oysters, when he withdraws the machine, and places it with its living attachments in some favorable locality that he wishes to stock with the bivalves. M. Costé has thus transplanted 20,000 young oysters at one time on his apparatus, which he assures us may be easily managed, and and on which the young oysters may be carried to any reasonable distance. It may be seen, therefore, what immense profits the extensive

oyster grounds of the Chesapeake might be made to yield with skillful management and improved machinery, when under the present clumsy system a profit is realized, after paying an annual rent of $300 or $400 per acre.

The oyster commissioners of the Chesapeake report a gradual diminution in the oyster crop in the past ten years, and estimate, by the same rates of decrease, that the whole stock will be exhausted in a half century. It behooves the sovereign States that have jurisdiction over these valuble oyster grounds to encourage, by legislative aid or otherwise, the propagation and culture of oysters, both as a source of wealth to the States themselves, and as an article of food and luxury for the people. The means, as well as the knowledge and skill, are now required to increase successfully the numbers and protect the spat, as well as to discriminate as to the best and most prolific varieties; for improvement may as readily be made in quality as in quantity. Until recently the supply by natural increase was considered inexhaustible, and no aids, either legislative or otherwise, were deemed needful or advisable. But now, when an interest of so much importance to the States most directly concerned, and to the whole country, is threatened with extinction, the means for its preservation become a necessity. Not only its preservation may be readily accomplished, but its value may be greatly enhanced; and, by proper management, the oyster grounds of the Chesapeake can be made to supply a demand equal to that of our whole country at the present time.

COUNTRY ROADS AND ROAD LAWS.

The term "country roads" is intended to include all descriptions of wagon roads in rural districts, which are made and repaired under the general direction of "county commissioners," "police," or "circuit courts," or, as in some States, under a board of "town supervisors," and in others under the "selectmen" of the towns. The immediate supervision of construction and repairs is generally under the direction of local "road supervisors," or "path masters," as they are termed in some districts. The tax for road repairs is generally a capitation tax on male citizens between sixteen and sixty years of age. The number of days' labor required on public roads per annum varies in the different States from one day to fifteen. Although this system of levying road tax generally prevails, it is conceded that it is very defective, and, so long as it is continued, poor roads will be the inevitable consequence. There is probably no public interest in which sound and intelligent legislation is more needed than in the enactment and revision of our road laws. Any system which provides for the assessment and collection of a road tax in labor will be found inefficient, and totally inadequate to the purpose for which such tax is levied. The recorded experience of reliable men in all rural districts in this country—in some cases covering a period of more than two hundred years—of the defects of this system, is sufficient evidence that reform is greatly needed.

Although the amount of statistical information obtained in answer to the circulars issued from this Department is far short of what was anticipated, we are enabled from the data furnished to arrive at many important facts, that will serve as guides to those specially interested in the construction and repair of roads. It was hoped that the returns would be so full and explicit that a complete tabular report could have been compiled in accordance with the questions propounded.

The unsettled condition of many of the southern States since the close of the war has been such that few repairs of bridges or roads have been made, and probably few will be undertaken until reconstruction is thoroughly effected.

A report from Florida says: "No road laws, no bridges; streams are crossed by ferries, fording, or swimming."

P. T. Tannehill, of Henderson County, Texas, says: "Our roads are not worked, the wagoner making his own way. Soil remarkably favorable for roads. No macadamizing material in the State, none needed. Road laws in this magnificent State, like other laws, seldom executed. No turnpikes; don't need them. Roads last until they become too miry, when wagoners cut a new one. Texas can boast of the best roads, with the least work, of any State in or out of the Union. Our citizens generally regard work as *unconstitutional*."

E. S. Holden, of Stockton, San Joaquin County, California, writes that "the general character of public roads throughout the State, during wet seasons, is bad; in January and February, almost impassable. Necessity has stimulated the people to construct good and durable roads and turnpikes, and quite a number of pikes, from two to thirty miles in length each, have been finished, or are in process of construction. Those constructed will be passable at all seasons of the year. They are made by

the use of heavy, strong plows, with eight to ten yokes of oxen, or as many horses. The road-bed is back-furrowed up, so that the side gutters are from two to four feet in depth; the road-bed made is usually forty feet at base, and about thirty feet on the top, the natural soil covered with gravel twelve to fifteen inches in depth. Such roads become hard and dry, and equal to the best roads in the eastern States. Thus constructed they cost about $6,000 per mile. There are about sixteen miles of such roads in this county, and it is proposed to construct other similar roads soon."

The report from Utah Territory states, that "there are in Salt Lake County thirty-two miles of gravel road, and about eight miles of macadamized. The average cost of the former is $3,500 per mile; of the latter about $3,800 per mile."

Report from Marshall County, Iowa, states that one mile of graded and graveled road in that county costs $10,000, and yet the average cost of road repairs in the county is only $3 per mile. Report from Fond du Lac County, Wisconsin, states that there are twenty miles of turnpike in that county, twelve miles of which are graveled, and cost $1,000 per mile; and eight miles macadamized, costing $2,000 per mile.

The report from Baltimore County, Maryland, states that that county has one hundred and forty miles of macadamized road, which cost $5,000 per mile for construction, and $100 per mile annually for repairs. The metal of the roads is principally of very hard trap rock, expensive to break by the hand process, by which it was all prepared. The quantity originally applied was not more than ten cubic feet per linear foot of road, or about two thousand perches of twenty-five cubic feet per perch per mile.

Washington County, Maryland, has about one hundred miles of Macadam road, which cost $2,100 per mile. This metal is of limestone rock, which is obtainable on the line of all the roads, and may be broken at about one-half the cost of the trap rock. The repair of these roads is said to cost about $50 per mile per annum.

William Bacon, of Richmond, Berkshire County, Massachusetts, says: "We have a system of taxation for making and repairing roads that is tolerated by a law of the State, and is as old as the roads. It requires towns to raise annually such an amount of money as may be deemed necessary to keep the roads in repair for the year, to divide the towns into districts, and appoint a highway surveyor to each district, whose duty it is to see that the money apportioned to his district is seasonably and properly expended. This system is generally adopted in agricultural districts, and is popular, as it gives to any one the privilege of paying his tax in money or working it out with teams, at a price stipulated by the town. The system is good where the people are all interested in good roads, but there are many who are never ready to work or pay; and, if they pretend to work, it is more of a holiday affair than a matter of public benefit." This is the general experience of all observers of the working of this and similar systems. Mr. B. adds: "We had formerly many turnpike roads in this county, but the introduction of railroads, which now traverse more than half of the towns in the State, has set them aside entirely, and all have become county roads."

This is the case in many other districts, even where railroads are not so numerous as in Massachusetts. The most favorable location for a turnpike is frequently selected by the railroad engineer, nearly parallel with the railroad or contiguous to it; hence much of the heavy transportation is by rail, and the collateral turnpike is little used. With the increase of railroads in all parts of the country, the effect on nearly parallel

turnpike roads will be as above described; hence, when locating a new turnpike road, it will be well to consider the probabilities of the construction of a railroad at an early day in the same direction or route. If probable that the railroad will be constructed at no distant day, and yet the necessity is great for a hard road for immediate use, the width of the hard bed of such road might be made as narrow as would answer, thus reducing the cost of the road, and correspondingly reducing the sum sacrificed by the loss of traffic which may leave the turnpike for the railway. While the foregoing is undoubtedly true, as regards turnpikes running in the same direction and near the railroads, it is equally true that these same railroads will cause an increased demand for improved lateral roads, by which products may reach the iron way. As the railroads usually thread the valleys and mountain passes, and cannot be worked profitably in the direction of the heavy mountain slopes, the products of the hill country and of the vales between it and the railroads, together with return supplies, must be transported on wagon roads, at least until a great improvement is effected in the traction of the locomotive. As these roads will be permanent, and are frequently required to overcome heavy grades, skillful engineering, thorough construction, and repairs are demanded.

The reports from nearly all the States in which "plank roads" have been tested, under a great variety of circumstances, concur in condemning them on account of the great cost of construction, as well as for their lack of durability. From careful investigation we find that they have generally become unfit for use in from five to eight years, even where the material used was of a good quality. One plank road only is mentioned on which repair with the same material is continued. For their average cost see statement. The agents of decomposition, heat and moisture, being everywhere active, timber of the same kind and quality is found, when used in plank roads, to be most durable in climates and positions unfavorable to a perpetual supply of these elements. The writer was familiar with a plank road in Madison County, New York, about twenty years since. This road was mainly in an elevated mountain region having a northern aspect, and was covered with snow on an average fully four months of the year, and yet the remains of the material used, it being hemlock three inches in thickness, were all removed in eight years. The same material used in the Carolinas or in Florida would probably have become worthless in four years. A slight covering of earth on the planks is found to hasten decay, though it prevents wear. Yellow pine and cypress logs, used in the southern States in "corduroy" or causeway roads, where the logs are constantly covered with water from never-failing springs, and with a covering of earth of twelve to eighteen inches, and shaded by a tall, dense forest, have been known to remain sound for thirty years.

The causeway of logs has been a common mode of primitive road-making in low marshy regions, and is still common in the southern States, even on mail routes. The logs should have a good covering of earth, and depressions occasioned by irregular decay should be repaired as they occur. The durability of causeway logs is much greater when covered with ten to twelve inches of compact clay well rounded off, and if it is obtainable, with gravel on the clay, than where they are entirely covered with gravel; the latter being porous, rain falling on the road-bed penetrates directly to the logs, and draws the warm air after it, thus rapidly promoting decay, while the clay covering will shed off the water before it reaches the logs. The log causeway system of road-making in regions where the soil is wet, timber abundant on the spot,

only costing the cutting, and drainage among the green roots too expensive, must necessarily continue in use many years to come. From the statements elicited, it appears that a very large proportion of the roads of all the States, even in the older ones, are little more than a belt of natural surface, just wide enough to admit of vehicles passing when they meet; sufficiently cleared of trees, rocks, and stumps to be passable with the worst marshes causewayed. Many of the unfordable streams are still crossed by flat-boat ferries of the most primitive character; more shallow ones are forded, and a tree felled across the stream for foot travelers is the only bridge seen on streams many miles in length. The primitive bridges, for vehicles on such streams, are usually made by placing three or more round logs from bank to bank, without abutments, and covering them with flattened poles. As civilization advances, or these primeval structures become unsafe, their places are usually supplied with hewed or sawed timbers and flooring, with "King's post truss" on either side, using pins and wedges instead of the rods, or bolts and nuts used in more modern structures. Unless suitable stones are at hand, and more convenient than timber, logs are flattened and pinned one upon another, and used for abutments. These are in turn supplanted by more scientific wooden structures, such as the "Burr," "Howe," "Improved Howe," and other forms of trussed wooden bridges; or perhaps by iron bridges constructed upon some one of the many plans now in vogue—those known as the Bollman and Fink being considered the best in use in this country for railroad purposes.

With each successive improvement in the construction of bridges in all districts, where other characteristics of civilization, such as the clearing up of forests, &c., have made collateral and corresponding progress, it has been found necessary constantly or periodically to increase the span and height, from the water at ebb, of all bridges to be built. This necessity arises from the more sudden escape of rain-fall from the surface of cleared and swarded land, than from that of the forest with its accumulated mulch of ages, maintained by a net-work of undergrowth, through which water is greatly impeded in its flow to the stream, and a much larger proportion of it is absorbed by the earth than when flowing on a surface of smooth turf. Another effect of the sudden rising of streams from the rapid escape of water into them during excessive rainfall, is a waste of the fertility of steep tillage lands, which shed water directly into the streams. Where interval lands to any considerable extent border on the streams, this waste is intercepted, and the fertile washings of the higher lands are deposited on the meadows, by which the fertility is augmented by each successive flood, often forming valuable muck deposits which enterprising farmers return to the hilly lands, thereby restoring their lost fertility. Where the interval land is narrow, the effect of the excessive, increasing floods is to sweep these washings into the creeks and rivers. The effects of floods in dissipating the fertility of rolling, cleared lands bordering streams may be prevented, in a good degree, by keeping them in grass as large a portion of the time as is practicable; and, when they are laid down to grass, by constructing numerous surface water furrows in succession from the summit to the base of slopes, giving them good capacity and very gentle fall; thus the washing of the soil will, in a great degree, be prevented, a larger amount of water will be absorbed, and that escaping to the streams will be a longer time in reaching them, and the destructive effects of inundation lessened materially.

The proportion of area of the cleared lands of the middle and the eastern States, which would be greately benefited by the precautionary

system of surface gutters above recommended, is very large, and the annual waste of fertility and the damage from loss of fences, bridges, buildings, and even of human life, are so great as to warrant a notice in this connection, apart from its direct pertinency to the general subject in hand. We have been frequently called to relocate roads that have been entirely destroyed by floods in collateral streams, many of which roads had been repeatedly destroyed in places, and as often rebuilt. An ordinary degree of sagacity and common sense should have suggested the folly of locating such roads originally so low as to be subject to such casualties, and certainly the repeated ocular evidence of the error committed by the pioneer road surveyor (for such he must be called, as there was no engineering in the case) should have deterred the commissioner of highways from reconstructing such roads on the same sites. Many cases of injudicious road construction and waste of public money could be cited, were it necessary, to establish the fact that reform and retrenchment, greater skill and wiser legislation, are needed for the more economical and efficient management of the public roads throughout the country.

As the existing road laws in all the States are generally "unsatisfactory," a recital of many of them in this article is unnecessary. Oscar I. Strong, of Pocahontas County, Iowa, reports the following road laws in that State: "The board of supervisors has the general supervision of roads in the county, with power to establish or change them as provided by law. The town trustees levy a road tax each year of not less than one mill nor more than three on the dollar of the taxable property in each road district. A road supervisor is elected in each district, who has the supervision of the roads in his district, and it is his duty to keep these roads in as good repair as he can with the funds at his disposal; it is also his duty to require each able-bodied man between twenty-one and fifty years of age to perform two days' labor on the roads, between April and August of each year. The operation of the law does not give satisfaction. The average amount of work done on our roads does not exceed six dollars per mile per annum. The best road in the county is made of saw-dust."

E. M. Mackemery, of Leavenworth County, Kansas, reports as follows: "All the principal roads in the county are under the supervision and care of a scientific engineer, who is the adviser of the board of county commissioners. The roads are graded, and worked on an established system, and all thoroughly and substantially bridged with blue limestone of superior quality. In no State in the Union is there a greater pride, or a more intelligent appreciation of the value, comfort, and pecuniary profit arising from a well-devised system in, and a thorough improvement of, all classes of roads. An experience of twenty-nine years in Illinois, Iowa, and Missouri has established the conviction that more gratuitous labor is performed on the roads of Kansas than in any other western State. At a cost of a little less than $250,000 the county has bridged every stream on the principal roads leading from Leavenworth City. The city of Leavenworth has also, at a large expenditure, built all stone bridges, even beyond the city limits, to facilitate trade with the interior. After roads are opened, the annual amount expended per mile does not exceed $250.

Arthur Parks, of San Bernardino County, California, states that "every male citizen in the county, Indians excepted, is taxed one day's work or two dollars per annum, besides which there is a small direct tax. The law is generally enforced, but is not satisfactory, as it is not sufficient to keep one-fourth of the roads in order. Private subscriptions or

one hundred dollars each are not rare for 'mending our ways.' The citizens of this county fully indorse the leading paragraph of your circular; and, realizing its correctness, we are determined to take hold with a will, and have good highways."

There is great similarity in the systems of taxation for road purposes, it being generally a "poll tax" in labor, varying in the different States from one day to five per annum; and in some portions of the country a money tax, varying from one mill to two cents on the one hundred dollars; and in others a tax for bridge purposes alone, as high as four cents on the one hundred dollars of taxable property. Owing to the abundance and excellence of material in some regions, and the scarcity and inferiority of it in others, there is a difference of at least tenfold in the cost of construction and maintenance of good roads. Good ones are the exceptions in all the States. Those of eastern New York and of New England have generally a surface superior to those of almost any other portion of the country, but the grades are rarely reduced to what they should be. To the steepness of the grades in the line of the axis of the roads in those regions, and to the care in surface drainage, their dryness and smoothness of surface are mainly attributable, as it causes them to shed water rapidly.

The proper mode of construction of a road adapted to a large amount of heavy traffic, at all seasons of the year, depends greatly on local circumstances. The perfection and the durability of a road must, of course, depend on the material used in its construction, all other circumstances being equal. We shall treat the subject in the order in which the earthy and the mineral materials, in the various parts of the country, possess their respective superiority for use in the construction of county roads: First, the macadamized or broken stone road; second, the gravel, or proper admixture of natural pebbles of various sizes with a proper quantity of clay and sand, or loam; third, rotten rock, of various character; fourth, rotten rock, artificially mixed with clay; fifth, loam, in a natural state; sixth, artificial loam, made by mixing clay and sand; seventh, clay; eighth, sand.

THE MACADAMIZED OR BROKEN STONE ROAD.

For the sake of brevity in treating class No. 1, we shall designate the rock to be used by the terms hard and soft. The mode of preparing the foundation of a Macadam road should be modified according to the character of the soil of which it is to be made. It may, however, be premised that one essential condition to be secured in the use of every character of material is that of dryness. This secured, almost every variety of soil will form a suitable substructure for a macadamized road. It would be difficult to furnish specifications for the great variety of cases that may be presented, but we shall endeavor to give such general instructions as will meet all probable cases intelligibly, and will commence with the most difficult circumstances likely to be presented, viz., an extensive plain, level, or nearly so, with a tenacious clay soil.

To effect drainage under such circumstances there are but two modes known to the writer: First, by surface drainage, by the use of open ditches, or gutters, excavated on both sides of the road in the manner described. If practicable, the fall should be made both ways, from a point as nearly central as may be, and each gutter be extended to a point of discharge lower than the plane. The advantage of draining both ways is, that with ditches of the same depth at their discharge end, the fall will be doubled. In case the distance is great, and the labor of

producing sufficient fall in the ditches is considered too expensive, it will then be judicious to test the practicability of the other method. This consists in what we call pit-drainage. Its practicability can always be ascertained by digging a well, or by boring with a pile or post auger. If a stratum of sand or gravel, which will absorb water, is reached at a reasonable depth, say not more than forty feet, this plan may be adopted. Three or four wells, equally distributed as to distance will be ample to drain a mile of road. If the wells are to be stoned with rough stones, they should be excavated six feet in diameter, and the depth continued three feet below the surface of the stratum which is found to absorb water. The rough stone wall may be laid dry, but the stones should extend from the inner face to the bank, the smaller ends forming the inner face, thus forming a complete arch of every layer of stones. The wells may all be on one side of the road, or a portion of them on each side, and they should be covered with a strong lattice of cast iron, with meshes about two inches square.

The gutters should fall each way toward the wells, and the low places in the gutters on the other side of the road should be opposite the wells. At each of these low points a well a foot or two in depth should be excavated and stoned up. A tile or a stone drain with good fall should connect the shallow with the deep well. The greater the fall in these cross drains, the smaller may the conduit be, and the less the liability to clog. A slight circular depression should be made in the bottom of the surface gutters around the wells, in which the sediment in the drainage water may be deposited before it flows into the wells. It sometimes occurs that the water, not being carried off rapidly enough, will rise up to, and even above, the top of the well; but this is rare, and the foregoing mode will generally provide satisfactory drainage under the circumstances described. When practicable, the surface gutters conveying the water to streams or to ravines may be of more simple and of preferable construction. Where the water is to be conveyed a long distance, say half a mile in one direction, a fall of three inches to one hundred feet will answer. This will require the gutter to be six feet eight inches in depth at the discharge end. The bottom of the gutters must be smooth and graded with accuracy. The angle of the slope of the banks should not exceed thirty-five degrees.

In tenacious clay soils the margin of the surface of the substructure, on which to place a Macadam road-bed, should be at least one foot above the bottom of the gutters. It should be made smooth and solid, and have an underdrain at each margin of the macadamizing from six to twelve inches in depth, and an average of twelve inches in width. These drains may have a fall each way for five to seven rods, to a low point from which a lateral drain should extend under the side road to the gutter into which they are to discharge. The longitudinal underdrains are to be made of broken stones, and are to be filled up to the level of the surface upon which the macadamizing is to rest. The earth-banks on each side of the macadamized portion of the road should be twelve inches in height, and be sufficiently sloped to be self-sustaining until the broken stone has been applied, which will render them perfectly secure. The stone should be so broken that all, or nearly all, the pieces will pass through a two-inch ring. This is the rule adopted in England, where this kind of road has reached the greatest perfection.

We say "nearly all," for of course there will occasionally be stones which, unless too much time is spent in breaking them, will not come up to the standard. This subject is one of the utmost importance; and, if we are to be governed by the opinion of Macadam himself, we find

him declaring that cubes of one and a quarter inch are better than any larger; and he affirmed before a committee of the House of Commons, that his experience went to prove that the expense of keeping roads in repair was almost in the exact ratio of the sizes of stone used in each instance. Thus, a road constructed of metal broken down to cubes of one and a quarter inch would require to keep in repair but one-half the outlay necessary for one constructed of cubes of two and a half inches; so that the increased cost of construction in using the smaller broken metal will be fully compensated for by the saving in repairs and greater durability. In speaking of the metal as being in the form of cubes, it is not intended to convey the idea that each piece of stone must be a perfect cube, and all of equal size; practical men will of course understand that the term is figurative, and that the metal must of necessity be more or less irregular, and vary in size considerably. The broken stone for a new road should be applied to the depth of twelve inches and twenty feet in width to produce a first-class road. The lateral slope either way from the center of the road should correspond with that of the surface of the foundation; this slope should be about one-quarter of one inch to a foot. There should be an earth side track on either side of the macadamized portion of the road. The earth road, when dry and in good order, is more desirable than the Macadam, and materially saves the wear upon it. The foregoing specification, although referring more particularly to a road nearly level longitudinally, is equally applicable as a direction for macadamizing any road of the width mentioned.

The preparation and application of broken stone in road-making have hitherto been very expensive, thus presenting great discouragement to those desiring to improve roads upon this system, which we have no hesitation in pronouncing the best all things considered, as yet discovered. The cost, however, has of late been greatly reduced by the introduction of the "Blake Stone-Breaker," a machine of immense strength and efficiency, which has been satisfactorily tested in practical use. Thirty perches (twenty-five cubic feet to a perch) of the hardest trap boulders can be broken into the best road metal in ten hours by this machine. It requires about nine horse power to perform this amount of work in the time given. In a single hour it has been known to break four perches, or one hundred cubic feet, of stone of the foregoing character. With this machine the cost of breaking is reduced to thirty cents per perch, using coal at $5 50 per ton, and labor at $1 50 per diem, and an engineer at $2 50 per diem, who assists the two laborers employed in feeding the machine. The average day's work for a good hand in the spring, summer, or autumn is less than one perch, and in winter still less. The average price of such labor is about $1 50 per day at present, so that the reduction of expense by the use of the machine is not less than eighty per cent.

The stone-breaker referred to has elevators connected with it, which carry the stones to a considerable height above the machine, where they are deposited upon a sieve, through which the fine sand produced in breaking the stone passes, and is deposited by means of a chute in a tight compartment on the ground; while the stones running over the sieve are deposited in a kind of hopper, from which they are loaded upon wagons or carts by simply opening a slide or trap. In this manner the cost of loading is reduced to a nominal figure, being done almost instantaneously; while, if done by hand by shoveling from the heap, the cost of loading would be nearly half as much as breaking.

After what has been said with regard to the sand being carried down

through a chute into a tight compartment, we will explain why the trouble is taken to separate the sand from the broken stones at all, or care taken to deposit it in a tight compartment. It was found that this sand, produced by the trituration of stones of this quality in the process of breaking, is the very best material yet discovered for manufacturing "concrete stone" under the Ransom patent of England, which is rapidly coming into use in this country. About one hundred pounds of sand are made for each perch of stones broken, and all yet made by the machine in question has found ready sale to the "Ransom Concrete Stone Company of Maryland," at one cent per pound. It will be seen that in the neighborhood of cities, where the concrete stone is being manufactured to any considerable extent, a road may be macadamized at a very low cost, if indeed it is not found that the stones can be broken and applied at a cost which shall be less than the proceeds of the sale of sand produced from the amount of broken stone required, thus preparing the road metal free of cost, and leaving a profit to the constructors besides.

In the application of the broken stones to form a road-bed, although the process is simple, it is important that the surface of the earth substructure be kept free from ruts and tracks, as any depressions will fill with water, and soften the foundation at these points, thus causing the road to settle unevenly. Depressions in the stoned surface cannot be well repaired without "picking up" the metal to the depth of several inches. The material used in repair should be somewhat smaller or finer than that of which the road is formed. The portion repaired is to be thoroughly rammed with a "paver's rammer," and, when finished, should be slightly above the surface around it, which remains undisturbed. When the metal has been properly graded on a new road, the surface should have a slight dressing of clay, and a heavy roller should be passed over it until the metal comes to its bearing, before vehicles are allowed to pass over it. A road-bed twenty feet in width and twelve inches in thickness will require 4,224 perches of broken stone to the mile. The surface grade of the earth side tracks should correspond with, and be a continuation of, the grade of the macadamized portion. The side tracks should not be more than nine feet in width, as unnecessary width increases the difficulty of surface drainage.

Many professional road makers will take exception to the clay surface dressing, but it has been thoroughly tested in practice, and always with success. The effect is to bring the metal to a bearing at once, and to prevent the action of the wheels from destroying the angularity of the surface metal, a very important quality, as it is almost impossible, after the surface stones have become rounded, to get them to bind one with another, and form a first-class road surface. The quantity of clay applied should be sufficient only to fill the interstices between the stones, on the immediate surface, when the metal has come to its bearing. Another advantage of such an application is to render the superstructure of macadamizing water-proof, almost from the first, the importance of which, in assisting to maintain a dry foundation, is almost self-evident.

THE GRAVEL AND OTHER ROAD-BEDS.

Where the natural soil of a road consists of gravel of proper texture, in its natural state, the process of producing a very desirable road, for all except very heavy traffic, is simple and inexpensive. It only requires to have the surface of the road-bed raised by repeated plowings, the

furrows all being turned toward the center of the road. In case the natural surface has a slope to one side, the execution can still be mainly and most economically performed by the use of the plow, by turning the furrows in one direction. The plow should be what is called the "double right and left-hand plow," which may be used with great advantage. When the desired grade of the surface of the road and gutters shall have been produced, as nearly as practicable, by the use of the plow, it should then receive repeated harrowings. The remainder of the work may be most economically and efficiently performed by means of the grading machine, except the removal of considerable hills, or the filling of corresponding depressions, which, if the distance is short, may be best performed by the use of the common scraper; but, if it exceeds five or six rods, wheelbarrows, carts, or dump-wagons will be necessary. No hand grading is necessary, as the grader, propelled by a pair of active horses, will perform more of this character of work than fifty men, and at the same time do it better.

The width of such gravel road will, of course, be controlled by circumstances, the amount of travel and the character of it being the most important considerations. It may be remarked, however—and it is equally applicable to all roads, of whatever material—that they should not be made wider than is really necessary, otherwise the cost is greatly increased, as well as the difficulty of surface drainage, which, as was remarked in connection with Macadam road, is of great importance. A road constructed of natural gravel, and having a gravel sub-soil, will require to be raised less in the center, and the side gutters may be made more shallow than would be admissible with any other material.

Rotten rock.—This material is frequently found, in a natural state, quite well adapted to forming a road that will serve all the purposes for which earth and gravel roads are adapted. It rarely has a proper degree of tenacity, however, to enable it to bind, or retain desirable compactness.

Where this material lacks tenacity the defect is easily corrected by adding a due proportion of clay, but the proper proportion of each can be ascertained only by experiment. When prepared as they should be, a good road for ordinary country travel can be made from these substances.

Loam.—By the term loam we mean clay with an admixture of fine sand, and generally a liberal proportion of vegetable matter.

When the proportions of clay and sand are such that the soil will not bake, nor incrust when dry, nor become very adhesive when wet, it may properly be called loam. When the soil of a road-bed consists of loam, or the best soil obtainable, the directions for the use of clay are applicable, with the exception that loam does not require the extreme degree of surface slope recommended for clay.

The natural soil of the bed may be either clay or sand. The application of the other by hauling it on to the bed and incorporating it by means of the plow and harrow, will enable the engineer to produce from these two materials (each illy adapted alone) an artificial soil, which will answer the purposes of a road-bed quite satisfactorily. Gravel, consisting of water-worn pebbles, without an admixture of clay by which to cement them, is a poor road material, as it rolls from under the feet of the animals and from beneath the wheels, making the labor of teams on such a road very severe. A proper amount of clay added to, and well mixed with gravel, will greatly improve it as road material. The characteristics of all these materials are so various in different localities that the proportions need to be modified according to circumstances; and the

proper proportions in each respective case will be most readily and satisfactorily determined by experimenting with a number of samples, say a cart load of each, in different proportions, which should be carefully noted, all being placed contiguously on the road-bed where they will be equally exposed to wet and to use. A few months' experience, under such test of the various mixtures, will give the road maker data which theory cannot furnish.

In some sections of great area no other material than clay can be obtained; hence it must be used as road material in its natural state. The general principles involved in the construction of gravel, loam, and other roads, and described under those heads, are to be observed in constructing a road exclusively of clay; the gutters, however, should be made as deep as is practicable, and the road-bed as narrow as the travel will admit, and be as highly crowned as is admissible, thus guarding against absorption of water from the gutters, and effectually shedding the rain-fall from the bed. There is no material in the catalogue treated that forms so perfect and delightful a road for pleasure-driving as clay, when in a certain condition; but it is so difficult to be maintained in the desired state that it is judicious to incorporate sand or gravel with it, wherever practicable.

There are districts of country many miles in extent, where nothing but drifting sand can be obtained for making roads. Where the depth of the sand is great before reaching a tenacious subsoil, a road-bed of sand will be more compact and better, if made lower than the surface of the land on either margin, so that water may flow on to, instead of being drained off from, the road. Like clay, pure sand is not a desirable road material, and quicksands, not unfrequently found in extensive sandy regions, are dangerous. Where drainage of quicksands is impracticable, two thicknesses of planking laid over the place to be crossed, the lower planks running in the direction of the road, and the upper ones across it, have been found to answer very well as a sort of a floating-road. A contractor on the Knox and Lincoln railroad in Maine has recently encountered a quicksand into which he has sunk pile upon pile to the depth of one hundred and forty feet, and no indications of a hard substratum are yet apparent.

PLANK ROADS.

Plank roads have been so universally unsatisfactory that valuable space need not be occupied with directions for their construction.

I. A. Lewis, of Howard County, Missouri, says that a plank road was constructed in that county twenty-six miles in length, costing $100,000; but it has long since been abandoned. Numerous instances may be cited of their failure from all parts of the country, but not one in which they have been a success. A plank road is a good road when in proper condition, and may be a necessary kind in some districts of the country; hence it may be well to state that it is claimed that, by steaming the plank, and charging them with creosote, costing about eight dollars per thousand feet, board measure, their durability will be doubled.

THE LONGITUDINAL GRADE FOR A ROAD.

There is perhaps no branch of the subject under consideration which demands more attention by the engineer than that of the reduction of road grades to the minimum under all practicable circumstances. We can better afford to increase the length of a road considerably than to

retain grades, in places, so heavy that a team is unable to haul more than half, or perhaps one-quarter, the load it can on all the remainder of it. Roads which are steep in the line of their axis are not only more severe on teams, but they are dangerous, and much more expensive to keep in repair. Various opinions have been expressed by engineers and essayists on this subject. Mr. H. F. French, of Boston, Massachusetts, in a very able paper on roads, contained in the report of this Department for 1866, says: "In view of every consideration, except drainage, the level line is probably the best; but, as drainage is essential, and, as will be seen when we come to consider the construction of roads, it is desirable to make them as flat as possible transversely, a slight slope in the length of them is found expedient. This slope should be one in two hundred, which is sufficient for drainage without injury by washing, and adds little to the draught."

A grade of one in two hundred is a very desirable one, so far as draught is concerned, but it is nearer level than is practicable on any considerable proportion of our country roads; and, as regards drainage, it will be of little service. Much lateral slope is objectionable, but we do not consider that a slope of one-quarter of an inch to one foot is so, while it is sufficient to provide lateral drainage, which is more efficient than longitudinal drainage. The widest track of country wagons does not exceed five feet, and, with a slope of one-quarter of an inch to one foot, the difference in the height of the wheels when the vehicle is on the side of the road, is but one and a quarter inch, and this is reversed in returning. It often occurs in rural districts that it is practicable to drive a large proportion of the distance on the summit of the road bed, where the vehicle will be on a level. It is next to impossible to prevent road surfaces from rutting to some extent, and a "slope of one in two hundred" only, while it is so gentle that there will be no tendency to wash, will certainly keep surface water on the road-bed so long that much of it will be absorbed, which may be avoided in lateral drainage, without injury to vehicles, displacement of lading, or inconvenience to passengers. It is not practicable to give a rule for the exact amount of longitudinal grade of roads, as they are affected by so many circumstances. Primarily the best provision for business traffic should be considered paramount to all else, yet this has often to be modified by local circumstances, whether in regrading old roads or in locating new ones. In the latter, if the locality is mainly unsettled, and the probabilities are that the building sites will be most popular near the summits along the line of the projected road, the engineer should prospect contiguous lands, and so modify the route that the necessary laterals may connect with the road by grades that shall be easy, safe, and inexpensive.

There has been a very general and striking change in the taste evinced in locating rural homes, country seats, and farm buildings, of late, to provide for which a corresponding change in the roads by which they are to be reached has become indispensable. Formerly, the popular site for rural buildings was under the lee of elevated ranges of land, near the streams, or springs at the base of hills, to accommodate which the public roads generally traversed the banks of streams, in which position the drainage of all the high lands must pass under or over them. The advantages of the modern system are numerous, and the disadvantages few. The salubrity of the high sites, the more extensive and pleasant view secured from the buildings, as well as from the summit or the hill-side road by which the buildings are reached, the reduction of cost of construction and maintenance of such roads, the superiority of the grade generally obtainable, as compared with those along the streams,

and the greater feasibility of securing dryness about the buildings, as well as of beautifying the landscape in their vicinity, are among the most prominent advantages of the modern selections over the primitive. Some have urged as objections to the high sites, that they are bleak and cold, and that water is not convenient. The former objection is fully met in the modern improved methods of building, and of economically generating and circulating heat; while, by the use of improved hydraulic apparatus, the supply of water is made ample, and luxuries unknown in the old system are fully enjoyed.

Where objectionable grades, say of ten feet to one hundred, the heaviest that should ever be tolerated, are unavoidable, the following instructions for construction and repair should be observed: Avoid short curves in the road; make the bed wider on the hills than on the plains, and especially in the curves. If the road runs along the side of a slope, grade the surface of the bed, so that all water falling on it shall be cast to the gutter on the upper side, as there is great danger of accident in icy times, if any portion of the bed has a lateral slope with the hillside. On such road provide low water bars across the road at intervals of thirty to forty feet. These bars should be placed obliquely, and should discharge all the water in the gutter on the upper side. If the gutter is disposed to wash, it should be paved, and the curb of the pavement on the road side set so low that water from the road-bed may flow into the gutter the entire distance from bar to bar, instead of being required, as is frequently the case, to flow in the ruts of the road-bed until it reaches the bar, which it often overflows and washes away continuing to flow on the road until dangerous gullies are cut, requiring much expense to repair them. If the hill is long, say one-fourth to half a mile, the water should be carried across the road in culverts, one hundred to one hundred and fifty feet apart. The best and cheapest common road culvert may be made of hard-burned terra cotta pipes. On hilly roads they are rarely required of more than eight to ten inches caliber. These pipes need no sleeves, or bells, nor any cementing of the joints; and are less expensive than the common stone culvert, even where the stones are at hand. The capacity of the pipes, owing to the smoothness of their interior surface, is much greater than that of a stone culvert of the same area of cross section. The pipes should be burned like hard, red brick, and are then as durable as granite. The pipe culvert should receive the water from a shallow well, walled up with stones or bricks. This well should be in the line of the gutter on the upper side of the road. The water from the gutter should fall into the well over a flag on the wall of the well, and between two side walls, carried up with the other walls to a height sufficient for a proper opening, when the well and the opening in the upper side should be covered with a strong flag. This flag should overlap the inner face of the wall of the well at the opening, at least one foot, that animals may not step into the well. This arrangement makes the upper end of the culvert sightly, secure, and free from all dangerous effects. The trench in which the pipes are laid should have a fall, so that the water from the culvert may be discharged upon a natural surface, as it will be less liable to gully it than an artificial bank.

STONES ON EARTH AND GRAVEL ROADS.

In preparing earth and gravel road-beds, all small stones, down to half the size of a hen's egg, should be removed from the surface soil, as the tendency is for them constantly to work up to the surface, where they are injurious to the feet of the horses, and to vehicles, wear and

PLATE XVII.

Fig. 1.—Elevation of the grader *c*; oak plank, 3″ x 12″ x 6′; *h*, pole on which horses work; *d*, frame of 2″ x 3″ posts for driver to lean against, with bar 2″ x 3″ framed on top; *f*, cast iron wheel 1′ 4″ diam; hub of wheel 3″ center diam, 2½″ at end, length of hub 3′; hole for axle, ⅞ inch; *e*, levers of bent plow handles attached to frames *k*, in which fulcrum wheels *f* run; *i*, swingletree bolt; *r*, wrought iron plate ¼″ x 2″, bolted to plank and frame as support; *k*, iron frame ½″ x 2″, in which fulcrum wheel *f* runs; *m*, eye by which levers are attached to grader plank; *n*, steel plate on bottom of front side of grader, ¼″ x 3″; *a* ¾ round iron hook braces, attached to plank by an eye.

Fig. 2.—Plan of grader, showing mode of attachment to horses, with rolling fulcrum wheels *f*. The end of frame attached to eye *m* forms a vertical flexible joint, and the eye turning on pintle of hook, passing through grader plank, admits of the eye turning right and left, thus producing a sort of universal joint, by which levers are attached to plank. By bearing on levers, the weight of grader is thrown on rolling fulcrums, which admits of the operator discharging soil accumulating in front of grader. The horizontal angle of grader, with pole, is changed by moving one hook brace *a* forward and the other backward in cast plate *b*, bolted to under side of pole. The dotted lines show position of grader and braces when latter are changed in holes of cast plate. The object of changing angle of grader and pole is to cause grader to cut hard surfaces with greater efficiency, and to cause it to deposit surplus soil in front of it at either end. In grading loose surfaces, and where there is no object in casting to either side, the grader should be set at right angles with the pole. *o*, mortise on top of plank, into which the uprights of oblique frame are set; *p*, bolt of ⅞″ round iron, attaching pole to plank. This bolt should have an eye large enough to receive the head, for convenience in taking machine apart; bolt holes should go through plank; pole should be 3″ x 4″ at back end, inserted into plank full size; mortise in plank which receives pole should be of length to admit of changing angle of pole with grader.

Fig. 3.—Plan of plate *b*, ½ inch thick.

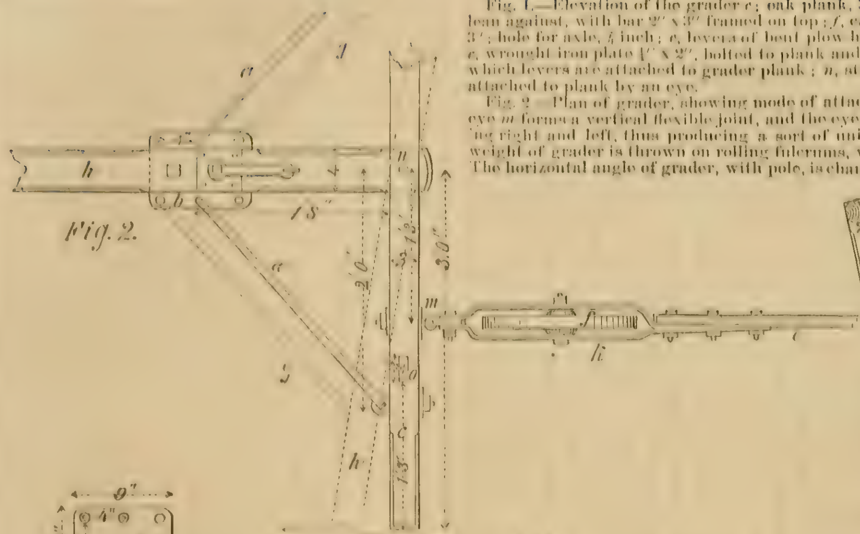


Fig. 2.

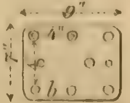


Fig. 3.

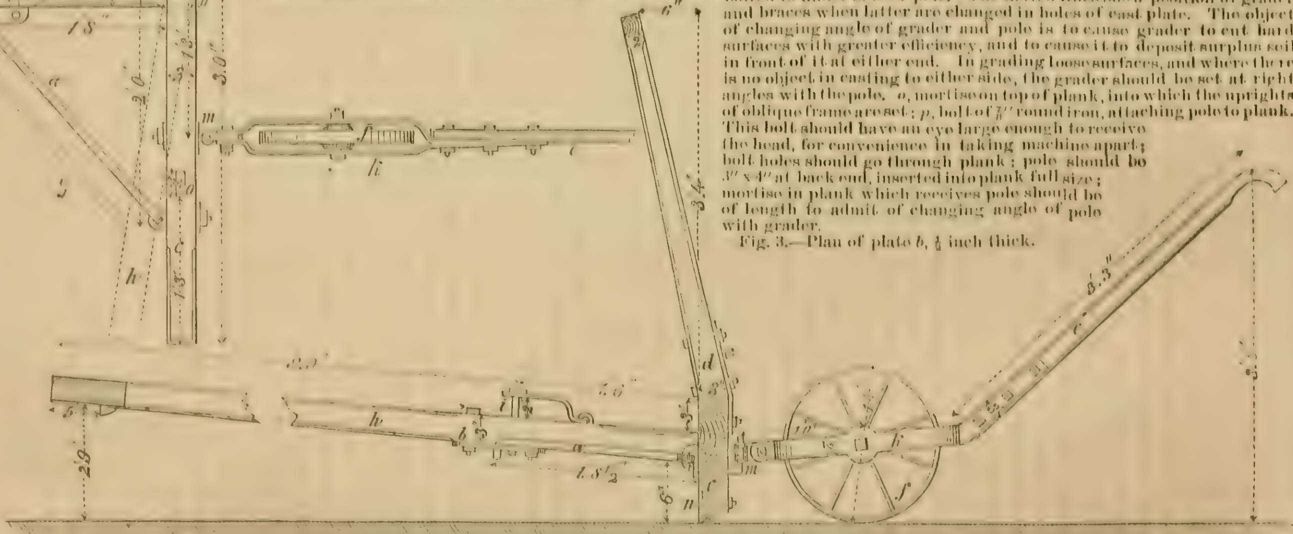


Fig. 1.

WILKINSON'S IMPROVED RUT SCRAPER AND GRADING MACHINE.

break the lading, and destroy the road. The wheel of a loaded vehicle, falling from a stone over which it has rolled, even if it is not more than two inches in height, will injure a road surface more than the natural rolling wear on a smooth surface in running a mile. The same may be said of the effect of loose stones on a macadamized road, only that the damage to the latter is more serious than to the earth-road surfaces, which will in some degree repair themselves; but the displaced macadamizing material is strewed upon the surface of the road, greatly increasing the evil. Next in importance to drainage is the removal of loose stones from the surface of the road, and the best and cheapest mode in thus clearing earth and gravel roads is to run the rut scraper or grader over the road, commencing at each margin with the scraper, so set that the surplus earth, stones, &c., will be continally deposited toward the center of the road. Having passed the scraper over the entire surface, by passing up one side and down the other, all the small stones to be removed will be deposited in a narrow row on the middle of the road-bed, from which they may be rapidly gathered by the use of the malleable cast-iron coal-scoop, which being latticed allows the earth and gravel to fall through. Loose stones may thus be removed from the surface of earth and gravel roads at perhaps one-tenth the cost of hand-picking, and all ruts filled at the same time. The loose stones on macadamized roads should be frequently picked off, and the side tracks kept in order by the use of the grader, as above described.

Great advantage and economy result from passing the rut scraper over earth and gravel roads as soon after every rain-fall as the soil becomes dry enough to flow before the scraper, and readily fall into the ruts and depressions in the road surface. Where water is allowed to stand until evaporated from the ruts, large and frequently dangerous mud-holes are the consequence; and as they are generally repaired by casting in stones, small and large, the road is made worse, instead of better. Mud-holes in roads are striking examples of a verification of the adage that "prevention is better than cure;" and prevention can be effected in the most simple and economical manner, by the use of the rut scraper. If taken in time, it is rarely necessary to haul soil for repairs, that removed by the scraper from the margins of the ruts generally being all that is requisite to raise the depressions to the proper grade.

The objectionable course of conveying surface water across roads on the surface, instead of by the use of a proper culvert, is common in all parts of the country, even on macadamized roads charging heavy tolls. The damage annually done to teams in such cases is more than the cost of a culvert. These water crossings are often, in winter, a sheet of ice ten to twenty feet in length and as wide as the road, in crossing which teams are often seriously injured by slipping.

WATER FOR TEAMS.

It is a matter of so great importance that a full supply of water by the roadside be provided for teams, at intervals of at least an average of five miles, that the subject should no longer be neglected, but a provision for securing a supply should be made in the county road laws. Except in very flat dry countries, it is generally practicable at trifling cost to arrange water troughs at proper intervals, so that water will flow in and out perpetually. The supply-pipe should always be inserted into the bottom of the trough, and not rise much above the surface of the water when the trough is full; for, if it does, the water is apt to be blown about and to freeze, so as to make the approach to the trough danger-

ous. If the water is received at the bottom of the trough, and the overflow is taken from near the supply, in a pipe to a culvert, there will be no ice about the trough. The supply-pipe should rise about half an inch above the level of the water in the trough, so as to form a drinking fountain for teamsters and travelers. In the heat of summer, teams will instinctively hurry their pace as they approach these grateful, thirst-slaking stations, and their comfort will be promoted to a degree that will well compensate for the outlay. The temperature of water standing in a trough exposed to the sun is more wholesome for working teams than that from cold wells.

WATER BARS.

The purpose of the bar is to cast the surface water from the road to the side or sides before it has accumulated in such amount as to cut the ruts into gullies. When the surface of the road has a slope to both sides, the bars should be placed opposite each other in the form of an obtuse V. The bottom of the V should be up the grade. There should be no gutter excavated in the road surface on the upper side of the bars, but the bar should be raised slightly above the road surface. No stones or timbers should be used in the bars; good gravel, where obtainable, is the best material. If the bars are placed as near each other as they should be on the heavy grades, the highest portion of the bars, that is, at the margins of the road, need not be more than three inches above the level of the surface of the road. On newly constructed roads, whether of broken stone, earth, or gravel, the water bars need frequent and particular attention until they become firm: in fact there is no portion of the road that will give a better return for the required outlay of of labor than the water bars.

SHELL ROADS.

A pleasant and durable road for ordinary light country travel may be made on a properly drained foundation, by applying shells to the depth of about eight inches, with a lateral surface grade of a quarter of an inch to the foot, but not sufficiently durable to be profitable for heavy traffic. A few years since, one of the main macadamized turnpikes leading out of Baltimore was repaired over a section of about half a mile in length, by dressing the stoned road with shells, applied about six inches in thickness. The solid bed of stones underneath and the heavy traffic on the surface soon ground the shells to powder, and when wet it became a bed of thin lime mortar, two to four inches in depth, which was so objectionable that the company were obliged to scrape up and haul off the whole mass in less than two years after the shells were applied. The circumstances described were particulary unfavorable for shells, as a test of their durability. The wear upon an ordinary carriage road in private grounds is not usually sufficient to reduce the shells to a good road in many years; hence they are not adapted for that use. A shell surface is inclined to rut, and work to the margins, and the shells are very difficult to move so as to repair the road by any hand process; while by the use of the grader, they may be readily and rapidly leveled in the construction of a new road, or regraded when displaced by wear. An active man with a pair of horses, with this implement, will repair two or three miles of shell road in a day, which would require the labor of at least seventy-five men to perform in the same time.

ROAD GUTTERS.

So much depends on the proper condition of the side gutters for the thorough maintenance and protection of the road, that the writer has been induced to give this branch of the subject special attention, and to test a variety of plans, in the hope of arriving at valuable and permanent improvement. Having realized his fullest hopes in one direction, a detailed description of the aim and its results may be given. Finding that the gutters, from the perpetual moisture maintained in them, were inclined to clog with rank, aquatic grasses, he sought to devise a plan to prevent the difficulty. The course pursued was to pave the gutters with boulders, set in about eight inches of washed gravel, and when they were all rammed in place, the gravel was swept from the interstices between the stones, to the depth of one inch, and its place supplied with heated, clean sand, which was saturated as it was applied, with a hot mixture of coal-tar and coal-tar pitch, two parts of the former and one of the latter, filling the interstices level with the surface of the pavement, producing a smooth uniform surface. The first experiment was made about twelve years ago, and has proved a perfect success, the effect being to prevent the growth of all vegetation, while the surface being smooth prevents any clogging with leaves, dead wood, and the like. Another valuable result attained was that the pavement, being made water-proof, is hardly affected at all by frost, keeping its place much better than when the stones are set in gravel alone, in the ordinary manner. This concrete dressing is not adapted to use in gutters where vehicles are allowed to run over it, particularly in cold weather; but it is admirably adapted to use in side gutters for country roads, and is greatly superior to any other gutter for carriage roads and walks in private grounds. The cost is about two cents per superficial foot more than the ordinary stone-paved gutter.

COUNTRY ROAD ENGINEERING.

Road engineering as a profession has not been sufficiently in demand in this country hitherto, to enlist the attention of those possessing experience, skill, and a thorough, scientific knowledge of the subject. The engineering of new roads and the alteration of old ones have generally been done by a land surveyor, or some student in railroad engineering, each deficient in a knowledge of the important work he attempts to execute; hence the defective character of most of these roads thoroughout the country. Not until the professional engineer shall receive greater encouragement to make common road engineering, in all its details, more a specialty, will it be more skillfully executed, and this encouragement will not be afforded until the masses are made more familiar with the importance of the subject.

There is one important principle in road engineering that should always control the grade of a road as far as practicable, and yet it is observed and acted upon only as the exception instead of the rule. It is that when a road is to connect two points, whether terminal or intermediate, and one is higher than the other, the inclination of the road should, if practicable, continually tend upward in one direction, and the reverse in the opposite. Instead of this we have examples all over the country where there is a descent, a fall in the grade, made up of a number of smaller or larger hills, from the low to the high point, that is really greater than the actual elevation of the high above the low point. A trifling divergence in the direction of the road, and frequently with

but a slight increase in its length, if any, will almost always remedy this great defect; so that a team, in traversing the road from the low to the high point, shall have but little, if anything, more than the real difference in the altitude of the two points to overcome. This error, if corrected in all existing cases in this country, would be of incalculable advantage to the community.

WIDTH BETWEEN FENCES.

It is important that the width of a road between fences should be ample to provide the material required in construction and repair, without endangering the fences by undermining the banks, and also to leave a grade that will be self-sustaining. Greater width is necessary in snowy districts than in those not subject to blockade from this cause. In the northern portions of this country there are districts where the cost of keeping roads open in winter exceeds that of repairs in summer. Increasing the width between the fences and keeping the gutters suitable for the use of sleighs have proved to be the most efficient remedy. The width required by law varies in the different States from two to four rods. In the opinion of the writer the latter width is not too great to be economical for highways generally. Walls, close fences, or close belts of trees, on road margins, are also objectionable, as they tend to blockade them with snow, and prevent the surface from drying.

SHADE FOR ROADS.

On all earth roads shade is objectionable in its effects on the surface, yet it is admissible to provide a good shade with deciduous trees on the summits, where the fullest benefit of the fanning breeze may be enjoyed, and shade will be least injurious. The effect of shade on stoned roads is less injurious than on those of earth. Abrupt banks or dense thickets on the south side of a road-bed, so high and near as to exclude the sun from it in winter, are very objectionable and dangerous, as such portions of the road are generally icy, when the remainder is free.

EXISTING ROAD LAWS.

There is a great similarity in the general road laws of the different States pertaining to the maintenance of county roads, the tax being generally a poll-tax on the male inhabitants between certain ages, though in some there is a trifling levy in money. The levy for the cost of new roads and bridges is usually in money, on all the taxable property in the rural districts. The system of labor-tax and of selecting road supervisors alternately throughout the districts, to direct the outlay of such tax, regardless of qualification or fitness for the work, notwithstanding it has so long and generally prevailed, is everywhere acknowledged to be very defective and unprofitable in its results.

PROPOSED SYSTEM.

All money required to construct and maintain the roads and bridges in each county should be raised by levying a tax in money. A competent county road engineer should be permanently employed, who should have the entire direction of all construction and repairs of roads and bridges in his district, with the power to draw on the treasury for the necessary means to meet all reasonable requirements in defraying the

cost of the work to be executed. He should be authorized to purchase all teams, vehicles and implements required, the same to be the property of the county, and to employ as many competent foremen as required for his district. They should have charge of these teams, &c., and have power to employ, control and discharge the number of laborers directed to be employed by the engineer. The foremen should each have their respective districts allotted them to be kept in repair. The engineer and his foremen and the laborers employed should be required to devote their entire time to labor on the roads. The water bars, culverts, bridges, and gutters should be examined as often as once a week, and all loose stones, and other surface obstructions removed. Work for repair of surfaces should be constantly pursued, and the principal amount of material required on the earth roads should be applied in the dry season. The winter should be devoted to quarrying stones for bridges, culverts, and macadamizing, and in raising and hauling gravel, and depositing it where it may be readily applied at the proper season. With such a force in charge of the roads the amount and quality of work executed would be more than double, and the actual tax required less than under the prevailing system.

COST OF ROADS AND EXPENSES OF REPAIRS.

According to all the returns from different States, the average cost of construction of gravel roads is $2,241 per mile, and the average annual cost per mile for repairs is $103. It appears, from the reports, that only a very few of the roads are improved by a gravel bed, and neither the width of the beds so improved nor the quantity of material applied is given. We may reasonably infer, however, that neither is greater than is absolutely required, and yet we find the cost of construction per mile to range from $700 to $4,000, and to average $2,241. The annual outlay per mile varies from $4 to $200, the average being as above stated, $103.

By reference to the table showing the cost of repairs to common roads per mile throughout the country, we find it to vary from $1 to $59, and the general average is $18 11 per mile.

The returns show that the average cost of construction of macadamized roads per mile is $3,290, and it varies in the different States from $500 to $6,336. The average annual cost per mile for repairs of macadamized roads, as reported, is $40, varying from $10 to $100 per mile.

The average cost of construction of plank roads per mile is reported to be $3,000, and the average annual cost of repairs per mile is $550.

The following table, compiled from replies to circular issued by the Department, shows the average annual cost per mile of repairs of common roads in the respective States:

State.	Cost p. mile.	State.	Cost p. mile.	State.	Cost p. mile.
New York	$21 82	Virginia	$6 00	Missouri	$10 59
New Jersey	27 50	North Carolina	6 50	Illinois	10 31
Massachusetts	59 16	South Carolina	1 60	Indiana	38 28
Rhode Island	33 75	Georgia	7 53	Ohio	23 60
Michigan	23 60	Florida	18 00	Minnesota	20 00
Wisconsin	24 70	Alabama	4 84	Iowa	20 00
Pennsylvania	18 28	Mississippi	8 60	Kansas	8 00
Maine	40 00	Louisiana	2 00	Nebraska	5 00
Connecticut	9 00	Texas	7 95	Utah	43 00
New Hampshire	16 00	Arkansas	6 43	Colorado	.. ..
Vermont	25 00	Tennessee	17 00	California	23 00
Maryland	11 00	West Virginia	8 40	Nevada	10 00
Delaware	14 50	Kentucky	13 57	Oregon	25 00

BRIDGES.

The writer has observed in various parts of the country common errors in bridge construction, which he proposes to notice, with remedial suggestions. At the present comparative prices of wood, stone and iron in all districts, except perhaps on extensive prairies, where the former two are very scarce, wood and stone are considered so much cheaper than iron that they are generally used. Where good quarry stones and suitable sand and lime or cement are conveniently attainable, the span required not more than thirty feet, rock foundations for the abutments within reasonable depth, and the banks of a proper height, the stone arch with stone parapets is, perhaps, as economical a structure as can be adopted. Where greater spans are required, and the banks are low, stone abutments and well constructed frame covered bridges are preferable. Not a doubt exists of the economy of siding and roofing wooden bridges, and of extending both over the abutments, so as to effectually protect from rain the timbers and planking at these points, as they are known to decay first when not protected. There is a frame covered bridge in Harford County, Maryland, which was built more than fifty years since, and is still safe.

Among the errors in bridge construction, those most common are the injudicious distribution of material, particularly of timber; the contraction of the water way, so as to expose the superstructure to liability to be swept from the abutments; neglecting to bolt the superstructure to the abutments; laying the flooring with close joints, instead of with proper openings, to prevent water from standing on the floors; using perishable varieties of timber, and even allowing the sap-wood to be used in part, by which all is reduced to its ephemeral character. No error is perhaps more common, and none results in so needless and speedy destruction of the longitudinal timbers of bridges, as the want of attention to keeping them dry, where they rest on the abutments, and especially at the ends where they support the earth-filling of the road-bed.

The durability of the timbers may be increased by introducing a light back sill and short light joist about two feet in length, with a plank on edge resting against them, to support the filling independent of the main, horizontal timbers, that air may circulate around the ends; and by covering the ends of all timbers resting on abutments and piers with several thickness of tarred paper, these being the points where decay often destroys when the other parts are unaffected.

MINERAL FERTILIZERS OF THE ATLANTIC STATES.

The economy and necessity of the use of mineral fertilizers have been so long admitted and are now so generally appreciated that it is deemed sufficient, in the limits of this article, to state the locality, extent, and nature of the wide-spread and liberal deposits of mineral manures in the Atlantic States, with some analyses, and such statistics as are attainable, showing their accessibility and cost.

Fertilization, in its widest sense, includes two processes: 1st, supplying the soil with materials intended to furnish plant food, either directly or by rendering available substances already present; 2d, the addition of matter for its physical effect merely; the former method is chemical, the latter mechanical, fertilization. Lime and greensand are examples, among mineral agents, of the first class; sand and clay of the second.

The elements supplied to the plant by mineral fertilizers are (omitting the least important, and those existing in the vegetable but in extremely minute quantities) lime, soda, potash, and acids of phosphorus and sulphur. Fertilizers of this class, then, generally speaking, will include all minerals capable of supplying these materials, either with or without chemical or mechanical preparation prior to admixture with the soil. Practically, however, the number of substances used is determined by the ingredients needed by the plants cultivated and lacking in soils, and the expense of obtaining them and reducing them to a form easily assimilable by the vegetable.

Lime constitutes the base of all the important fertilizers of this class in the United States, excepting the greensand marls, of which the New Jersey formation is the type, in which the percentage of lime is so small that it may practically be left out of consideration.

Limestone, or natural stratified carbonate of lime, in all its varieties, is available for agricultural purposes wherever it can be economically mined and prepared. This preparation consists essentially in the reduction of the stone to a finely comminuted state, which is usually accomplished by burning. In districts where fuel is scarce and water-power at hand, stamping or grinding may be found more economical, though the product will be slower in its action; and, lacking the causticity of burned lime, will not aid so effectually in the decomposition of organic matter.

Admixture of magnesia with lime is not now, as once, believed to be injurious to the fertilizing power of the latter. Dolomites and dolomitic limestones accordingly find a place among mineral manures; but, from their composition, are necessarily less efficient than the purer limestones.

Sulphate of lime, gypsum or plaster, has a well-established and high rank among fertilizing agents, furnishing to the soil sulphuric acid, in a readily assimilable form, as well as lime; and, though not widely disseminated, exists in large quantities, so as to be cheaply obtainable at most points.

Phosphate of lime is found in many natural forms. The shell beds, sands, and marls contain it; and one or two veins of almost pure apatite have been opened. The fossil excrement of marine animals, known as

coprolites, is very rich in phosphate of lime; and, although not found in great mass in the United States, forms an important part of many of the richest marls of the south. By far the most important source of this material, however, is the recently discovered deposit of South Carolina. While lime may be considered the base of this fertilizer, undoubtedly its most important ingredient is its phosphoric acid.

The term "marl" having so many and such different significations, dependent upon local usages, as well as the various classifications of scientific geologists, it is highly desirable that it should be limited to some specific fertilizing material or class of materials, rather than, as now, be made to include deposits as far apart in their chemical constitution and value as in their period of formation. At least, when used, it should be so qualified as to indicate the mineral species to which the substance belongs.

The marls of the United States may be divided into argillaceous, glauconitic or greensand, and calcareous. Argillaceous marls are of comparatively little agricultural value, if we consider their chemical constitution only, consisting mainly of clay and sand, with a trifling percentage of lime. There are circumstances, however, as before alluded to, in which they may become true and valuable fertilizers. Glauconitic marls include the greensands of New Jersey, Delaware, and Maryland, and a few localities further south. They are dependent, for their power of permanent beneficial action, upon the potash and phosphoric acid they contain. Full analyses of these deposits will be found in the report of the chemist.

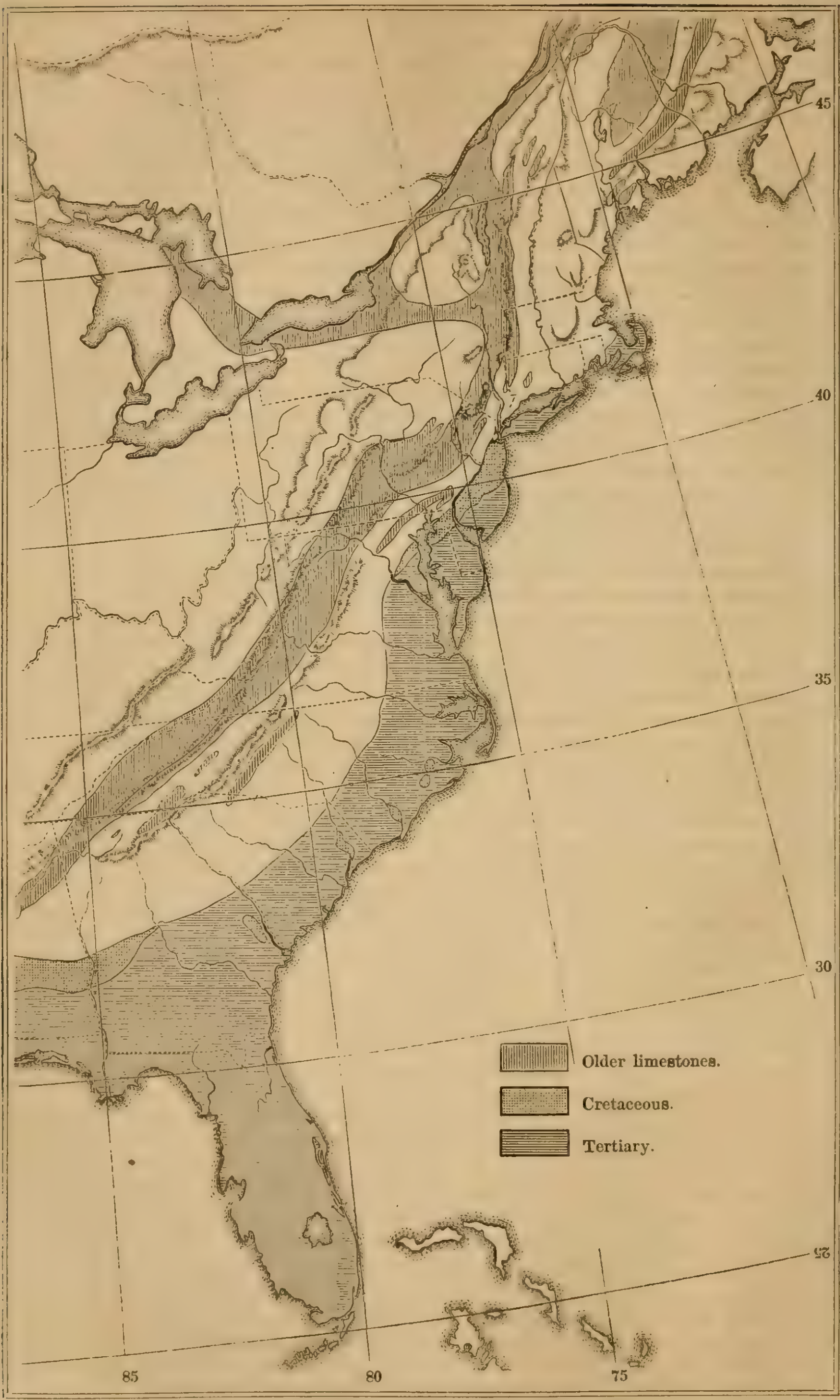
Calcareous marls are the débris of countless successive generations of life, the remains of which may or may not be recognizable, according to the amount of pulverization and attrition they have undergone from the motion of the water in which they were deposited, and the subsequent conditions to which they have been exposed. These deposits range in time from the cretaceous epoch of geologists to the present era, and are even now in process of formation both in marine and inland waters. They are found in greatest amount in the tertiary strata.

The foregoing account of the origin of marl applies with equal force to most of the limestones. Marls, however, are generally understood to be friable to a considerable extent, and this, together with the fact that many of the marls retain a sensible proportion of organic matter, constitutes a line of distinction between the two. This line is one, however, often hard to draw; for, if it is true that even the hard and crystalline limestones are but the result of various forces, as heat and pressure, acting upon sedimentary strata containing organic remains, it is evident that there may be all grades of consolidation and homogeneity according to circumstances.

The physical character of calcareous marls varies with the class of animals, remains of which form their active ingredient, and the state of preservation of the latter; and their agricultural value varies with the proportion of inert matter they contain, and which frequently forms a matrix for the shells and other organic formations.

The deposits known as pond marl, or sometimes as shell marl, found in our lakes and ponds, or upon their former sites, and often under peat, explain, by their formation, which may be watched in all stages, the mode of origin of the greater part of the calcareous group. Water containing carbonic acid is, under pressure, a solvent of carbonate of lime, from which the microscopic testaceous animals inhabiting such water, by absorption and secretion, form their shells; and, dying, these are deposited, either to accumulate in vast masses, or, if the water is not

Plate XVIII.



MAP ILLUSTRATING THE LOCALITY OF THE LIMESTONES AND CRETACEOUS DEPOSITS OF THE ATLANTIC STATES.

sufficiently charged with lime, to be redissolved, reabsorbed, and to supply new generations with covering.

Any excess of carbonate of lime in the earth is absorbed in the passage of the water through it: and thus deposits of this kind form chiefly in limestone regions.

In some localities a process similar to the foregoing has caused the formation of large beds of silicious marl, so called. Various species of phytozoa—organisms occupying the border between the animal and the vegetable kingdom, and in spite of many attempts to locate and classify them, not yet definitely assigned to either—possess a shell or skeleton of silica. These accumulate, as in the case of the testacea, and like the calcareous pond marls are both fossil and recent. The beds underlying Richmond, Virginia, are of the former character.

Silicious marl, being a fertilizer only in the sense that fine sand is, namely, a physical amendment, will not be further noticed; as it is now believed that all soils contain sufficient silica to supply the wants of plant life, and only require assistance in rendering it soluble.

Pond marl, from its friability, minute division, and superficial location, is, in districts where it can be had, the cheapest and best of the purely calcareous manures. It may be applied as extracted or in a calcined condition. In some localities large amounts of this marl are manufactured into lime.

The recent calcareous tufa, travertin or calcareous sinter, formed by the precipitation of carbonate of lime direct from its solution in water when exposed to the air, is often called marl. It is, however, a true and pure limestone; and, physically much resembling the pond marl, is for the same reasons a cheap and ready fertilizer.

Few States having, as yet, been throughly surveyed with reference to their agricultural and their geological character and economical resources, statistics are necessarily incomplete, and much fuller for some regions than for others of perhaps equal importance. The object of this article, however, being as much to point out deficiencies as to present the results of investigations already undertaken, such information as is accessible will be presented, in the hope that those interested may be induced to communicate more complete and recent information.

If the recent discoveries on the southeastern coast may be taken as an indication of what is to follow, the field of research is indeed an inviting one.

The older calcareous formations of the Atlantic States constitute a belt of considerable breadth, coinciding nearly with the great eastern mountain chain of the continent, and having numerous offshoots and local outcrops, at greater or less distances from the main range. (See map.) In the eastern States the limestones belong to the so-called Azoic, and to the Lower and the Upper Silurian formations: in other words, the earlier geological ages. The limestone of the Upper Silurian enters Maine from New Brunswick on the northeast; while the same together with the Lower Silurian (Trenton) appears in the mountains of Vermont. Extending along the east line of New York, and approaching somewhat near the coast in northern New Jersey, the limestone belt described passes through Western Virginia, North Carolina, and northern Georgia to its southern limit in northern Alabama.

The newer calcareous rocks and deposits belong either to the Carboniferous, the Cretaceous, or the Tertiary formation. The Carboniferous limestone appears in Pennsylvania, and, lying west of and parallel to the Silurian, is traceable to the same distance southwest, occasionally being found in or east of the tract occupied by the older rocks.

Limestone of the Cretaceous epoch of the States under consideration is found in Georgia only, the formation being represented further north by the greensand marls. These marls in New Jersey, Delaware and Maryland lie next to the Tertiary, but further inland, and outcrop irregularly, but in a general direction easily traced, through the latter, along the whole Atlantic coast.

The Tertiary formation occupies a belt of very gradually increasing width, extending from southern New Jersey to and including Florida, separated from the limestone range by gneiss, slates, and sandstones, over a wide area. In the tertiary are found large and numerous beds of shell-marl and limestone, the latter invariably the result of consolidation and cementation of the former. In these deposits the shells are frequently almost unchanged either in appearance or chemical composition.

At many points on the coast is found a still more recent formation, the Quarternary or Post-Pliocene. This is the locality of the South Carolina phosphates.

Having thus indicated the general topography and geological character of the mineral fertilizers of the Atlantic States, the specific localities in each State will now be noticed.

MAINE.

Maine is well supplied with limestone of good quality, and so distributed through the State as to be readily available. With the exception of the calcareous beds of the Lower Helderberg of northern and of eastern Maine, which, as before mentioned, is continuous with that of New Brunswick, the limestone of Maine is of the azoic age, and of crystalline or saccharoid texture. The largest outcrops of this rock are in the counties of Knox and Waldo, and have long been worked for lime, for many years supplying the greater part of the lime used in the eastern States. The convenience of access to the main quarries, those of Thomaston, and the excellence of the lime there manufactured, very early created a large demand, which still continues.

The beds lying immediately upon the Keag River, Knox County, are strongly dolomitic. The beds of Waldo County are located in its southern part, and have been largely worked. Numerous small outcrops are found in York, Oxford, and Androscoggin; and in Franklin, Somerset, and Kennebec the beds are not only numerous but extensive. In southern Sagadahock several localities of the rock are reported; also in southern Aroostook and Lincoln, and in Penobscot Counties. In Hancock County the rock, so far as examined, seems to be so altered as to be of little economic value.

The Helderberg limestone of northern Aroostook, northern Penobscot, eastern Washington, and central Piscataquis probably underlies a large extent of country, but has not yet been thoroughly examined. This rock has been manufactured into lime to only a limited extent; its product, however, is of good quality. Thorough analyses of the lime-rocks of Maine are not accessible. The percentage of carbonate of lime in a few specimens is as follows:

Oxford County	79.6
Androscoggin County	43.6
Franklin County	65.0
Somerset County, highest	88.0
Kennebec County, average	75.0
Penobscot County, highest	89.2
Piscataquis County, average	62.0

Comparatively few localities of pond-marl are reported in Maine; but from their distribution, and the geological character of the State, it is probable that many others exist. Near Ambejijis Lake, Piscataquis County, and in Limerick, York County, are large and easily worked deposits, the Limerick marl lying under peat. Beds are reported at several points in Hancock and Washington. In the former county these have a special value from the lack of limestone of good quality. Marl is found in Oxford and Franklin also; though of the Oxford marls one bed at least, that near Brownfield, is purely silicious. Large deposits of pond-marl are suspected to exist in the county of Aroostook; and a few have already been opened, from one of which the marl was obtained of which the following is an analysis:

Carbonate of lime	84.51
Carbonate of magnesia	0.24
Sesquioxide of iron	2.12
Organic matter, vegetable	2.08
Alumina and silica	9.13
Loss	1.92
	100.00

NEW HAMPSHIRE.

The limestone of New Hampshire is altogether crystalline, and of the same formation as the older lime-rock of Maine. It has been found and described in the counties of Grafton, Hillsborough, Sullivan, and Coos. Analyses of New Hampshire limestones give results of some economical importance, some specimens yielding sufficient magnesia to indicate a probable value as water-lime; and others, such a proportion of silica as to cause the formation of slag in burning, unless great care is exercised. These remarks apply, of course, to any limestones of similar composition.

Limestone from Grafton County.

	1.	2.	3.
Carbonate of lime	99.3	90.66	90.8
Mica and silica	0.5	3.80	8.2
Carbonate of iron and manganese	0.2	5.54	1.0
	100.0	100.00	100.0

Limestone from Hillsborough County.

Carbonate of lime	75.2
Oxide of iron and alumina	2.4
Silica	21.0
	98.6

Limestone from Sullivan County.

	1.	2.
Carbonate of lime	56.4	23.8
Carbonate of magnesia	10.8	46.0
Oxide of iron	Trace.	2.8
Silicious matter	33.0	25.0
	100.2	98.2

Pond marl is reported in Coos County only, but there is every probability of its existence elsewhere. A decomposed limestone found near Lyme, Grafton County, is there known as marl.

VERMONT.

As already mentioned, the greater amount of limestone in Vermont is found along or near the line of the Green Mountains; though, in the words of Professor Hitchcock, there is scarcely a town in the State where it does not exist in some form. Generally speaking, west of the mountains the limestones are purely calcareous, while to the east they are often decidedly magnesian. The azoic crystalline limestone appears in Vermont, as in the preceding States, and is widely distributed. It is found in the eastern parts of Franklin and Addison, in Lamoille, western Washington, Rutland, Windham, and Bennington. In Windsor the rock is extensively manufactured into lime.

The limestones of Western Vermont are of the Hudson, Trenton, and so-called Eolian or Taconic groups. It has been recently claimed, however, that the limestones of the Trenton formation and the Eolian are identical. The Eolian supplies the finest marbles of Vermont, and extends through western Bennington, central Rutland and Addison, and western Chittenden, easily reached at most points, and furnishing a strong and pure lime. The Hudson and the Trenton limestones are found in a narrow range along the northern half of the western border of Rutland County, occupying a wide area in western Addison and southwestern Chittenden; then, dipping under the lake, they reappear in Grand Isle and Isle Lamotte, and in the northwestern part of Franklin County.

Orange County, Caledonia, and Essex seem to possess no limestone rocks. Through the center of Orleans County, running nearly north and south, lies an isolated ledge of Upper Helderberg limestone, very silicious, as will be seen from its analysis.

Limestone from Chittenden County.

Carbonate of lime	84.45
Carbonate of magnesia	12.14
Alumina and oxide of iron	1.01
Silica, &c	1.50
Water and loss	0.90
	100.00

Limestone from Franklin County.

Carbonate of lime	92.9
Carbonate of magnesia	5.5
Silica	1.6
	100.0

Limestone from Windham County.

Carbonate of lime	30.82
Carbonate of magnesia	2.51
Alumina and oxide of iron	2.05
Silica	60.00
Water and loss	4.62
	100.00

Marble from Rutland County.

Carbonate of lime	97.73
Alumina and oxide of iron	0.59
Silica and mica	1.68
	100.00

Limestone from Bennington County.

Carbonate of lime	85.18
Carbonate of magnesia	13.11
Alumina and oxide of iron	1.79
Silica, &c	1.49
	101.57

Limestone from Addison County.

Carbonate of lime	51.35
Carbonate of magnesia	44.76
Alumina and oxide of iron	2.00
Silica, &c	1.40
Water and loss	0.49
	100.00

In view of this general distribution of calcareous rocks it would naturally be expected that many localities of pond-marl would be found in Vermont, and accordingly we find numerous beds of this fertilizer in a belt of country twenty to thirty-five miles in width, extending through Windham, Windsor, and Orange, along the Connecticut River, and northward through Washington, Caledonia, and Orleans. In the western portion of the State the only deposits reported are on Grand Isle and at Monkton, Addison County. But four analyses of Vermont marls are at hand, but these may safely be taken as representative.

Marl from Grand Isle.

Carbonate of lime	82.6
Carbonate of magnesia	2.5
Silica, and trace of alumina, and oxide of iron	2.6
Water and organic matter	12.3
	100.0

Marl from Orange County, (Williamstown.)

Carbonate of lime	89.0
Carbonate of magnesia	4.2
Silica, and trace of alumina, and oxide of iron	1.0
Water and organic matter	5.5
	99.7

Marl from Caledonia County.

Carbonate of lime	83.5
Carbonate of magnesia	1.0
Silica, and trace of alumina and oxide of iron	4.2
Water and organic matter	10.5
	99.2

Marl from Addison County.

Carbonate of lime	72.9
Carbonate of magnesia	2.4
Silica, and trace of alumina and oxide of iron	11.2
Water and organic matter	13.6
	100.1

MASSACHUSETTS.

The Eolian limestone of Vermont extends into western Massachusetts, and, as in the former State, furnishes lime of the best quality and in immense quantities. Its outcrops are confined to Berkshire County, running north and south across the State; but the crystalline azoic makes its appearance in all the counties of the State, to a greater or less extent, except in the peninsula of Barnstable and its neighboring islands, which are recent.

Limestone from Berkshire County.

	North Adams.	West Stockbridge.	Sheffield.
Carbonate of lime	99.60	98.10	97.80
Carbonate of magnesia		1.16	
Oxide of iron	Trace.	0.14	
Silica, alumina, &c	0.40	0.60	2.20
	100.00	100.00	100.00

Limestone from Middlesex County.

	Chelmsford.	Littleton.
Carbonate of lime	56.52	54.70
Carbonate of magnesia	39.38	43.35
Oxide of iron	0.90	0.51
Silica, alumina, &c	3.20	1.46
	100.00	100.02

Limestone from Franklin County.

	Ashfield.
Carbonate of lime	46.85
Carbonate of magnesia	1.60
Oxide of iron	1.55
Silica and alumina	50.00
	100.00

Limestone from Hampshire County.

	Middlefield.
Carbonate of lime	56.25
Carbonate of magnesia	31.56
Oxide of iron	1.12
Silica, alumina, &c	11.07
	100.00

Limestone from Hampden County.

	Agawam.	Springfield.
Carbonate of lime	[illegible].41	93.45
Carbonate of magnesia	15.33	[illegible]
Oxide of iron	5.53	....
Silica and alumina	45.36	5.00
	[illegible]	[illegible]

Limestone from Norfolk County.

	Walpole.
Carbonate of lime	70.30
Silica and alumina	29.70
	100.00

Limestone from Essex County.

	Newbury.
Carbonate of lime	80.72
Carbonate of magnesia	2.97
Oxide of iron	0.72
Silica and alumina	8.00
	92.41

Limestone from Worcester County.

	Bolton.
Carbonate of lime	61.80
Carbonate of magnesia	27.00
Silica and alumina	1.20
	90.00

Pond-marl is reported only in Berkshire County, at Stockbridge, Pittsfield, and Lee. It is of rich quality, as seen by the following analyses:

	Stockbridge.	Pittsfield.	Lee.
Organic matter	8.9	6.6	4.4
Phosphate of lime	0.7	0.7	1.0
Carbonate of lime	73.4	86.4	88.8
Carbonate of magnesia	0.1	0.4	No trial.
Silicious matter	13.5	3.1	4.4
Water	3.3	3.0	1.4
	99.9	100.2	100.0

In the Tertiary, on the coast of Plymouth County, and at Gay Head, a greensand was described by Professor Hitchcock, and hopes were at one time entertained that its fertilizing value might be found to approximate to that of the New Jersey formation. These expectations were hardly warranted by its chemical constitution, which lacks both phosphoric acid and potash; and, so far as is known, no use is at present made of this material, in agriculture at least.

RHODE ISLAND.

Limestone in Rhode Island exists only in the northeastern portion of the State, in the townships of Cumberland, Smithfield, and Providence, and on the Lime Islands of Newport Harbor. It is of a geological formation similar to that of eastern Massachusetts, and frequently dolomitic to a considerable degree.

Rhode Island limestone.

	Cumberland.	Providence.
Carbonate of lime	[illegible]	56.1
Carbonate of magnesia	[illegible]	32.5
Insoluble matter	[illegible]	11.4
	[illegible]	100.0

	Smithfield.	Lime Island.
Carbonate of lime	92.4	53.2
Carbonate of magnesia	1.2	37.9
Oxide of iron	[illegible]	1.9
Insoluble matter	6.0	7.0
	100.0	100.0

No marl of any kind has been found in Rhode Island; or, if found, has not been reported.

CONNECTICUT.

The Eolian limestone may be followed from Massachusetts nearly across the State of Connecticut, western Litchfield County and Fairfield possessing large and valuable beds of limestone and marble. Numerous localities of limestone are found through eastern Fairfield and the western half of New Haven and northeastern Litchfield. Limestone is reported in New London County, but as being difficult of extraction. A bituminous limestone is found in the southern part of Hartford County in limited quantity. Analyses of the Connecticut limestones are not accessible. In general character, however, they agree with those of western Massachusetts.

Pond-marl is reported in Farmington only, the analysis of which is as follows:

Organic matter	12.5
Phosphate of lime	0.4
Carbonate of lime	64.1
Carbonate of magnesia	No trace.
Siliceous matter	[illegible]
Water	2.9
	[illegible]

NEW YORK.

The largest development of limestone which occurs in the Atlantic States, outside of the great belt already described, is found in New York. This lies parallel with the lake coast of the State, and includes

the Niagara, the Salina, the Lower and the Upper Helderberg, and the Hamilton limestones of the New York survey: or, in more general terms, the later lime rocks of the Upper Silurian and the earlier one of the Devonian age. The calcareous members of the Lower Silurian group, including that heretofore mentioned as Eolian, are found running on, and parallel with, the eastern boundary of the State, and also bearing southeast from the eastern end of Lake Ontario through several counties. The azoic crystalline variety appears to some extent in the counties along the St. Lawrence river. The following counties are reported as having limestone within their limits, under circumstances rendering it available for economic purposes: Albany, Clinton, Columbia, Dutchess, Essex, Franklin, Jefferson, Lewis, New York, Niagara, Oneida, Onondaga, Madison, Otsego, Orange, Putnam, Rockland, St. Lawrence, Saratoga, Schoharie, Seneca, Ulster, Wayne, Warren, Washington, and Westchester.

In Schoharie County is found a pulverulent tufa, known as agaric mineral, of which an analysis will be found below. This exists in sufficient quantity to be of some importance. Large beds of the same formation, but of more compact texture, are found in Herkimer, Onondaga, Monroe, Cayuga, Tompkins, Livingston, Erie, Franklin, Greene, Niagara, and Saratoga. Some of the tufa beds are sufficiently consolidated to furnish building materials.

The State of New York furnishes nearly all the gypsum or plaster manufactured in the United States—perhaps the most important beds being located in the district traversed by the Erie canal; though the distribution of the mineral is wide, as will be seen by the following list of localities. Gypsum is found in quantity sufficient to pay for extraction in the counties of Cayuga, Herkimer, Livingston, Madison, Monroe, Niagara, Oneida, Onondaga, Ontario, Seneca, and Tompkins. An impure variety, but fit for agricultural purposes, is found in Wayne County also.

A vein of phosphate of lime, at Crown Point, Essex County, was at one time somewhat extensively worked; but, being so much mingled with rock as to preclude its profitable extraction, it has been abandoned.

Of the extent of the lime and plaster industry in New York some idea may be formed from the fact that, in 1865, one hundred and fifty manufactories of these materials were reported, including only those on a somewhat extensive scale, and manufacturing for commercial purposes. These minerals form the basis of a large manufacturing industry, namely, the making of hydraulic cements, (water-limes,) mastics, &c., of which the gypsum and magnesian limestones form the necessary constituents.

Pond-marl is reported in more than one-half of the counties of New York, namely: Albany, Allegany, Cayuga, Cattaraugus, Chautauqua, Chemung, Columbia, Cortland, Dutchess, Genesee, Greene, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Rensselaer, St. Lawrence, Saratoga, Seneca, Steuben, Tioga, Tompkins, Ulster, Warren, Washington, and Wayne. Of these deposits, those of Cayuga and Columbia are the most extensive, and those of Tioga, Orleans, and Warren probably the least.

Limestone from Dutchess County.

Carbonate of lime	60.50
Carbonate of magnesia	39.50
	100.00

Limestone from Niagara County.

Carbonate of lime	75.65
Carbonate of magnesia	20.70
Silica and alumina	2.25
Oxide of iron	0.35
Water and loss	1.[illegible]0
	100.00

Limestone from Madison County.

	1.	2.
Carbonate of lime	98.50	99.30
Oxide of iron	0.35	0.20
Insoluble matter	0.90	0.40
	99.75	99.90

Limestone from Rockland County.

Carbonate of lime	93.50
Insoluble matter	3.75
Water and loss	2.75
	100.00

Limestone from Westchester County.

Carbonate of lime	53.24
Carbonate of magnesia	45.89
Silica, alumina, and oxide of iron	0.87
	100.00

Tufa from Scoharie County.

Carbonate of lime	97.25
Silica	0.80
Organic matter	1.95
	100.00

Tufa from Saratoga County.

Carbonate of lime	95.00
Silica, alumina, carbon	5.00
	100.00

Gypsum from Cayuga County.

Carbonate of lime	21.65
Sulphate of lime	71.75
Clay	6.60
	100.00

Pond-marl from Onondaga County.

Carbonate of lime	83.00
Silica	10.00
Alumina	7.00
	100.00

Pond-marl from Orange County.

Carbonate of lime	93.75
Silica and alumina	6.25
	100.00

Pond-marl from Ulster County.

Carbonate of lime	92.75
Silica and alumina	3.25
Organic vegetable matter	4.00
	100.00

Pond-marl from Herkimer County.

Organic matter	19.20
Silica	1.10
Phosphates of iron and alumina	0.45
Lime	46.25
Magnesia	0.45
Carbonic acid	31.05
Potash	0.55
Soda	0.35
Chlorine	Trace.
	99.40

Pond-marl from Greene County.

Carbonate of lime	97.32	91.75
Insoluble silica and alumina	2.15	8.25
Oxide of iron and organic matter	0.53	Trace.
	100.00	100.00

Pond-marl from Seneca County.

	1.	2.	3.	4.	5.	6.	7.
Moisture	4.50	2.50	1.00	2.71	3.48	9.96	8.57
Organic matter	8.50	.90	4.20	4.32	1.65	2.12	2.10
Insoluble sand	6.60	11.70	6.00	5.58	5.00	13.00	26.65
Carbonate of lime	77.10	79.40	83.33	82.98	83.35	67.30	56.80
Magnesia	2.10	3.50	2.16	3.60	4.00	3.00	1.60
Phosphoric acid and alumina	1.20	2.00	2.80	.81	.86	.61	.37
Chloride of sodium					.20	.13	.14
Sulphate of lime			.50				
Sulphuric acid					.46	.38	.27
	100.00	100.00	99.99	100.00	99.00	96.50	96.50

Pond-marl from Essex County.

Silicic acid	59.20	22.60
Phosphoric acid	1.15	2.35
Carbonic acid	9.92	28.15
Sulphuric acid	0.15	0.09
Lime	12.73	36.26
Iron	3.40	1.15
Magnesia	0.55	0.35
Potassa	0.45	0.36
Soda	0.40	0.67
Chlorine	0.11	0.12
Organic matter	11.66	8.44
	99.72	99.94

NEW JERSEY.

The limestones of New Jersey, adopting the classification of Professor Cook, State geologist, are the white crystalline of the azoic age, the magnesian, and the fossiliferous. The out-crops of all these are easily

traceable to corresponding formations in New York and Pennsylvania, and are limited to the northwestern portion of the State. The azoic limestone is found in the counties of Sussex and Warren, mainly in the Sparta and the Vernon Valley, and, to a limited extent, in the southern part of Passaic, and the northern townships of Morris County. Analyses of this limestone are appended. This rock has been worked for lime to only a trifling extent, though yielding an article of good quality. Magnesia, in considerable proportion, is found in by far the greater number of the lime rocks of New Jersey, some of them being true dolomites. The formation, distinguished as magnesian by Professor Cook, is found principally in the counties of Sussex and Warren, which, indeed, contain nearly all the limestone of the State. It extends into northern Hunterdon, and is found in small beds in southwestern Morris, northern Somerset, and eastern Passaic. This rock is considered by Professor Cook to correspond, in geological position, with the calcareous sand rock of the New York survey, lying beneath the Trenton. Probably ninety per cent. of the lime manufactured in New Jersey is from this formation.

The fossiliferous limestone corresponds to the calcareous rocks of the Trenton and the Helderberg group. A belt of the former extends from the New York line southwest to Belvidere, on the Delaware, and of the latter from the northern to the southern line of Sussex County, along the Delaware, west of Kittatinny Mountain. These fossiliferous rocks yield an almost pure lime.

The so-called yellow marl, or limestone of the cretaceous epoch, found in connection with the greensand, is also made available as a source of lime. It is confined to the counties of Monmouth, Burlington, Camden, Gloucester, and Salem, varying in quality with its location. In Salem County it is hard and compact, and is burned for building purposes.

Several extensive deposits of calcareous tufa are reported in northwestern Sussex, near the Delaware River.

Near Hurdstown, Morris County, crystalline phosphate of lime (apatite) is found, sometimes in large masses. The same causes which enforced the abandonment of the Crown Point mine, in New York, have prevented the profitable extraction of the New Jersey phosphates.

The greensand marls of New Jersey, the discovery of which revolutionized the agriculture of that State, are described fully in the report of the chemist. The recent report on the geological survey of New Jersey presents some statements as to the amount of greensand raised, transported, and used, of which the following is an abstract.

The amount transported by rail, and used almost exclusively beyond the greensand region, was:

In 1867 .... 126,740 tons.
In 1868 .... 134,000 tons.

In 1867, marl was delivered along the line of the Delaware and Raritan railroad at prices ranging from \$1 50 to \$1 60 per ton, and to other points as follows:

Price per ton of twenty bushels.

	Squankum Company.	Pemberton Company.	White Horse Company.*	West Jersey Company.
Bridgeton	....	....	....	\$1 85
Burlington	....	\$1 25	....	....
Belvidere	....	3 95	....	....
Birmingham	....	80	....	....
Bordentown	\$3 40	1 90	....	2 45

* Along the line of Camden and Atlantic railroad, at 80 cents per ton, and upward.

Price per ton of twenty bushels—Continued.

	Squankum Company.	Pemberton Company.	White House Company.*	West Jersey Company.
Camden	....	1 70	....	1 70
Freehold	2 40	....	....	....
Marlborough	....	....	....	90
Mount Holly	....	95	....	....
New Brunswick	3 30	2 90	....	3 40
South Amboy	3 30	3 60	....	3 50
Salem	....	....	....	2 00
Trenton	3 40	2 10	....	2 65

* Along the line of the Camden and Atlantic railroad, at 80 cents per ton, and upward.

Freights upon the Delaware and Raritan canal were lower than the preceding by thirty to fifty cents per ton. Prices at pits range from two cents to eleven cents per square foot in the ground, and from thirty-five to fifty cents per ton when dug. The aggregate amount of greensand marl used annually in New Jersey is estimated at one million tons. The extraction of the marl is accomplished, either by removing superincumbent strata and digging from above downward, or, more generally, by working into hillsides and the banks of water-courses. In both cases much trouble arises from the accumulation of water. At Squankum and Woodstown, after removal of the overlying material, the surface of the marl is flooded, and the work done rapidly and economically by floating steam-dredges.

Shell marl of the Tertiary period is found in Cumberland County, at and near Horse Run. It is of two qualities, distinguished as black and gray, of which the latter is the best and most plentiful. The black, containing a large percentage of sulphuric acid, should be neutralized by lime before application to the soil.

Of pond-marl, large and easily accessible beds exist in the Wallkill and the Kittatinny Valleys of Sussex County.

Azoic limestone.

	Passaic.	Warren.	Sussex.		Morris.
Lime	29.01	54.04	28.31	55.13	23.74
Magnesia	10.80	0.53	18.04	....	16.82
Oxide of iron and alumina	5.30	1.30	1.20	0.45	15.70
Potash and soda	0.21	....	Trace.	....	....
Phosphoric acid	....	....	Trace.	....	....
Silicic acid, quartz, &c	....	0.90	9.50	....	14.70
Carbonic acid	23.00	43.06	42.08	43.32	26.20
Insoluble in acid	29.30	....	....	85	....
Water and loss	2.38	17	87	25	2.84
	100.00	100.00	100.00	100.00	100.00

Magnesian limestone.

	Somerset.		Hunterdon.	Passaic.	Warren.			Sussex.		
Lime	26.3	32.4	27.7	29.5	29.8	30.1	29.6	28.5	29.4	29.1
Magnesia	17.4	15.5	17.4	20.3	19.9	20.1	19.2	17.3	20.3	19.1
Carbonic acid	41.1	42.5	43.0	45.6	45.4	44.4	46.2	41.5	45.7	44.9
Oxide of iron	1.3	8.4	1.9	2.2	1.0	.6	1.1	1.7	.6	.3
Alumina	4.0					.2				[illegible]
Potash	.3	......	......	......	......	.2	......	......	......	[illegible]
Soda	.3	......	......	......	......		......	......	......	.5
Phosphoric acid	......	......	......	......	......	.2	......	Trace	......	.2
Silicic acid and quartz	8.0	2.0	7.2	1.1	3.4	3.5	2.9	9.9	1.8	3.6
Water	.7	......	......	1.0	......	.4	......	.3	......	.3
	99.4	100.8	97.2	99.7	99.5	99.7	99.3	99.2	97.8	100.3

Fossiliferous limestone from Sussex County and Warren.

Lime	53.4	48.2	54.7
Magnesia	.4	2.2	....
Carbonic acid	42.6	31.4	43.0
Alumina and oxide of iron	1.0	1.6	.2
Alkalies	....	....	.4
Silicic acid and quartz	2.7	15.8	1.5
	100.1	99.2	100.1

Yellow limestone from Salem County.

Phosphoric acid	0.14
Sulphuric acid	0.86
Silicic acid	25.81
Magnesia	1.81
Alumina	4.91
Oxide of iron	3.07
Carbonate of lime	60.81
Water	2.24
	99.65

Phosphate of lime from Hurdstown, Morris County.

Phosphoric acid	42.34	43.23
Oxide of iron	0.04	trace.
Lime	55.08	53.37
Chlorine	0.34	1.02
	97.80	97.62

Gray tertiary marls from Cumberland County.

Silica and quartz	56.50	50.20
Oxide of iron	3.07	3.38
Alumina	2.84	1.95
Lime	15.30	19.71
Magnesia	0.69	0.50
Potash	0.97	....
Soda	0.58	0.63
Sulphuric acid	5.56	2.09
Phosphoric acid	0.45	0.70
Carbonic acid	9.80	15.05
Water and loss	4.24	6.15
	100.00	100.36

Pond-marl from Sussex County.

Lime	50.27	50.38
Magnesia	0.62	0.36
Carbonic acid	38.57	38.90
Water and organic acids	4.10	4.34
Alumina and sesquioxide of iron	0.45	0.16
Phosphate of lime	0.30	0.66
Silica	0.48	0.37
Organic matter	4.19	3.54
Water	1.87	1.29
	100.85	100.00

PENNSYLVANIA.

In Pennsylvania the limestones, with the exceptions hereafter noticed, are confined to a well-marked belt running east-northeast and west-southwest across the State, bounded on the northwest by the main range of the Alleghanies and on the southeast by the range of hills known as South Mountains. In this belt the Upper and the Lower Silurian limerocks appear in innumerable outcrops. So general is the distribution of

limestone within the district described that it would be hard to name a township, save in the anthracite coal basins, which does not possess a convenient source of lime of sufficient purity for agricultural use. South of South Mountains there are three limestone regions—that known as the Limestone Valley of York and Lancaster; the marble formation of southern Montgomery, central Chester, and southern Lancaster; and a narrow belt entering central Bucks County at the Delaware, and extending nearly across the county.

Throughout the coal-fields of western Pennsylvania carboniferous limestone is found outcropping along the borders of streams and in similar locations, in quantity very variable, but gradually increasing in proportion to the other carboniferous rocks, until the Ohio line is reached. It will be seen, by this necessarily meagre description of localities, that, with the exception of five or six counties in the northeast corner of the State, and a narrow district along the northern boundary, every portion of Pennsylvania is supplied, to a greater or less extent, with calcareous rock. In a region of this geological character the formation of pond-marl is more than probable, though we can find no mention of such deposits.

DELAWARE.

Altered limestone, similar to that of southeastern Pennsylvania, is found in northern Delaware, near the State line.

Greensand marls similar to those of New Jersey appear in northern Delaware. The beds of this fertilizer on the western shore of the Delaware River lie altogether in the southern half of New Castle County, between the Delaware and Chesapeake Canal and Appoquinimink Creek, extending from the river to the Maryland line. The shell marls of the tertiary, so common from Maryland southward, do not appear in Delaware, though shell beds of aboriginal and even more recent formation are not rare, and in the southern portion of the State have furnished no inconsiderable amount of lime. They are found on the bay shore, chiefly from the center of Kent County to lower Sussex.

Limestone from Newcastle County.

	White.		Dark.
Carbonate of lime	78.5	53.3	54.4
Carbonate of magnesia	9.0	46.6	45.2
Alumina and oxide of iron	Trace.	0.6	1.0
Talcose residue	12.1	0.3	0.2
	99.6	100.8	100.8

MARYLAND.

The northern counties of Maryland, with the exception of Cecil, are all supplied with limestone, corresponding to the Pennsylvania formation, of which it is an extension. That of the counties of Baltimore and Harford is altered and crystalline, furnishing very good marble. That of Carroll, Frederick, Washington, and eastern Alleghany has the ordinary character of limestones of the Trenton group. That of western Alleghany county is carboniferous. Beds of greensand, continuous with the same formation in Delaware, occupy lower Cecil, almost all of Kent County, and, crossing the bay, appear in Anne Arundel and Calvert,

and to some extent in Prince George and Charles. South of this belt of the cretaceous formation, the shell marls of the tertiary are found in great abundance, although on the Eastern Shore they dip southward, and lie too low for profitable extraction south of the counties of Talbot and Caroline. In the peninsular counties the shell marls are easily reached wherever ravines and gullies have been formed or the banks of the larger bodies of water are abrupt. In Maryland the line between the cretaceous and the tertiary formation is not sharply defined, so that the characteristic marls of the two epochs are found commingled in Prince George and in Charles.

Limestone from Baltimore, Frederick, and Washington.

Carbonic acid	42	46	43	43.5	39	42	47	41
Lime	54	30	55	55.5	49	54	31	29
Magnesia		18					18	17
Silica	4	6	2	.1	11	2	2	9
Undetermined					1	2	2	
Oxide of iron								4
	100	100	100	99.1	100	100	100	100

Shell marl from Talbot County.

Silica	56.00	20.00	50.00
Alumina	3.50	10.50	3.00
Carbonate of lime	37.00	54.50	42.00
Oxide of iron	2.50	10.00	4.00
	99.00	95.00	99.00

Shell marl from Queen Anne County.

Silica	43.00	45.00
Alumina	4.25	5.00
Carbonate of lime	50.00	50.00
Oxide of iron		4.00
	97.25	104.00

Shell marl from Prince George County, (slight admixture of greensand.)

Silica	47.75	[illegible]
Alumina	9.75	5.00
Carbonate of lime	29.50	[illegible]
Oxide of iron	7.00	[illegible]
Potash	2.00	[illegible]
	96.00	[illegible]

Shell marl from Caroline County.

Silica	37.00	[illegible]
Alumina	4.20	[illegible]
Carbonate of lime	47.05	[illegible]
Oxide of iron	8.25	[illegible]
	96.50	97.25

Shell marl from Charles County, (some greensand.)

Silica	58.25	[illegible]
Alumina	8.00	6.44
Carbonate of lime	21.90	45.04
Oxide of iron	5.80	4.10
Potash	1.55	1.00
	95.50	94.50

The foregoing analyses of marls, extracted from the Report on the Geological Survey of Maryland, by Ducatel, were made after removing the larger shells, and consequently do not represent the full value of the marls in carbonate of lime. They are almost all, however, so silicious as to forbid transportation beyond the immediate neighborhood of their occurrence.

VIRGINIA.

The mineral fertilizers of Virginia being fully treated in another place, will not be noticed here.

NORTH CAROLINA.

The localities of older limestones in North Carolina are few and widely separated. Those reported, with one exception, are in or near the mountain district. In the counties of Cherokee and Macon, valuable limestone and marble outcrop in large quantity on the bluffs and banks of streams. In Madison and in Buncombe a crystalline magnesian limestone is found, and has been worked to some extent. A belt of calcareous rock crosses the State from Stokes county through Catawba, Lincoln, and Gaston, to King's Mountain, in South Carolina, which has been extensively quarried. Such being the location of the older limerocks of North Carolina, and the facilities for transportation being very limited, the greater portion of the State is necessarily dependent for lime upon importation, or on the marls and limestones of the tertiary formation, of which many are so consolidated as to be available for architectural purposes, as well as the manufacture of lime. A bed of "marly limestone," probably of this character, is reported in the northern part of Wake County. Such consolidated beds are found in Wayne County, along the Neuse River, together with more friable marls. Large deposits of shell marl exist in Bladen County containing many coprolites. Near Newbern vast beds have been opened, and marl of varying consistence and quality is found along the course of the Tar River, from Nash County to southern Edgecombe, as well as on the Lower Roanoke and the Neuse. On the last named river, and on the Lower Cape Fear, the greensand outcrops through the Tertiary, but does not compare in agricultural value with that of New Jersey, Delaware, or Maryland. Like the similar deposits of Maryland, the shell marls of North Carolina are too silicious to admit of distant carriage. It has been suggested that a cheap process of separation of the silex, by washing, may be found practicable, but the experiment has not yet been tried on any extended scale.

Shell marls from Wayne County.

Silex	45.60
Phosphate of lime / Oxide of iron and alumina	8.25
Carbonate of lime	44.15
Organic matter and water	1.60
	99.60

Shell marl from Edgecombe County.

Silex	56.25
Phosphate of lime / Oxide of iron and alumina	7.50
Carbonate of lime	34.15
Organic matter and water	2.10
	100.00

Shell marl from Nash County.

Silex	16.25
Phosphate of lime / Oxide of iron and alumina	10.00
Carbonate of lime	71.75
Organic matter and water	2.15
	100.15

Shell marl from Craven County.

Sand	26.60
Water	1.70
Magnesia	0.10
Carbonate of lime	71.22
	99.62

Shell marl from Jones County.

Silex	13.00
Phosphate of peroxide of iron and alumina	1.10
Carbonate of lime	85.20
Carbonate of magnesia	1.02
Potash	0.02
	100.34

Massy shell marl from Bladen County.

Silex	52.50
Alumina, phosphate of lime, and oxide of iron	7.15
Carbonate of lime	40.50
Magnesia	.75
Potash and soda	Trace.
	100.90

Coprolites from Bladen County.

Silex	9.68
Phosphate of lime	71.59
Carbonate of lime	11.28
Magnesia	.50
Potash	Trace.
Organic matter and water	4.40
	97.45

Shell marl from Pitt County.

Silex	31.40
Carbonate of lime	54.60
Phosphate of lime and oxide of iron	3.20
Water	3.38
Magnesia	.22
Potash	Trace.
Organic matter	5.88
	98.68

SOUTH CAROLINA.

South Carolina possesses but little limestone. The formation mentioned as crossing North Carolina outcrops in York County, near King's Mountain, and also in Spartanburg. In the western edge of Pickens County, the limestone of the Blue Ridge appears, as in western North Carolina, upon the banks of streams. The Tertiary marls are distributed

through the eastern half of the State as in North Carolina, but differ in character from those of that State in containing much less silicious matter, and a considerable amount of phosphoric acid.

Of the importance that attaches to the recently opened beds of phosphatic fertilizer, located above the tertiary on the rivers Ashley and Cooper, treated in the report of the chemist of this Department, some idea may be formed from the fact that seven or eight companies are actively engaged in its extraction in the vicinity of Charleston. Three extensive manufactories in that city are devoted to the conversion of the raw material into commercial superphosphates, and several others are in process of erection, both there and at Savannah. The demand for sulphuric acid, used in the manufacture of the superphosphates, has caused the establishment of extensive works for its production on the spot. The total amount of the phosphates extracted up to May 1, 1869, is estimated by competent parties to be not less than fifty thousand tons. Of this amount the mills at Charleston consumed from six to eight thousand tons, about two thousand tons were sent to Europe, and the remainder was shipped to northern ports, including Baltimore. The cost of extraction and preparation for shipment is estimated at about six dollars per ton, exclusive of interest on capital, rent, or cost of land and the expensive washing machinery, tram-ways and wharves, required for operations on a large scale. The separation of the phosphatic nodules from the almost inert clays with which they are mingled, and which fill all cavities and depressions in the phosphatic masses, constitutes an important item of the cost of preparation for market.

The South Carolina phosphates are stated to be readily soluble, even in dilute acids; and, in the manufacture of the superphosphates, to be ready for bagging in forty-eight hours after mixture with the acid.

It is believed that other deposits, of character similar to those at Charleston, exist on the southeastern coast of the United States, and that the supply will be found to be practically inexhaustible.

Limestone from York County.

Carbonate of lime	85.00	75.00
Silica and mica	10.00	16.00
Alumina and oxide of iron	4.50	9.00
Carbonate of magnesia	0.50	Trace.
	100.00	100.00

Limestone from Pickens County.

Carbonate of lime	70.00
Silica	25.00
Alumina and oxide of iron	5.00
	100.00

Limestone from Spartanburg County.

Carbonate of lime	90.56
Mica and silica	6.40
Magnesia and oxide of iron	3.14
	100.10

Limestone from Laurens County.

Carbonate of lime	92.00
Silica, alumina, and oxide of iron	7.00
Carbonate of magnesia	1.00
	100.00

Shell marl from Sumter County.

Carbonate of lime	70.00
Silica	20.00
Alumina, oxide of iron, and loss	9.50
Phosphate of lime	.50
	100.00

Shell marl from Darlington County.

Carbonate of lime	60.00
Silica	25.00
Alumina and oxide of iron	15.00
	100.00

Shell marl from Cooper County.

Carbonate of lime	87.50	90.00
Silica	6.00	4.00
Alumina and oxide of iron	5.00	5.50
Phosphate of lime	1.50	.50
	100.00	100.00

GEORGIA.

In Georgia the older limestones are confined to the northern portion of the State, through which they are somewhat liberally distributed. They occur as marble of good quality in the counties of Gilmer, White, Cherokee, Hall, and Habersham, and in varying form in the more western counties. The most eastern development of the great Cretaceous bed of Alabama and Mississippi is found in the counties of Muscogee, Marion, and Stewart, manifesting itself as the well known rotten limestone. Immense beds of almost unaltered shells are found in central Georgia, within twenty or twenty-five miles of the gneiss and sandstone belt. The marl beds of the Tertiary in Georgia, with the foregoing exception, are similar, so far as known, to those of South Carolina, both in location and character.

FLORIDA.

The peninsula of Florida is almost everywhere underlaid with coral and shell marls of the Tertiary period, and generally consolidated. From this material a quarry on Anastasia Island, off the mouth of the St. John's River, furnishes a large supply of good building stone. Immense coast accumulations of recent shells and lime sand, formed by attrition of coral, also exist. Greensand marl has been recently reported as found in large quantity in Leon County, but no analysis has yet been obtained.

THE MARL REGION OF VIRGINIA.

From the falls of the rivers, and throughout the tide-water district, the whole country is believed to be underlaid by deposits of fossil shells, mostly near the surface, but often at considerable depths. It is these fossil beds which are commonly designated in Virginia by the general term of *marl*. They appear to have been formed at an era when the waters in which the animals lived were in a tranquil state: and the time they were undergoing the process of accretion must have been of incalculable duration. The tranquillity of the waters is indicated by the fact that the inclination of the beds toward the ocean is very gradual; that gregarious assemblages of the same species are frequently found imbedded together; and, above all, that many of the shells remain with the valves closed, and every part entire, as if death had ensued in a natural way; and even when separated the valves of the same shell are in close proximity.

Professor William B. Rogers made two divisions of this portion of the State. These divisions he indicated by the terms *miocene* and *eocene*, which are familiar to geologists as being applicable to different parts of the tertiary series. Under the designation of miocene are included the strata which occur in the eastern and much the larger portion of this region, in which several varieties of shell marl are procured in abundance; while the name of eocene is given to deposits of older date, existing beneath, and cropping out west of the preceding, and containing fossil shells of a different character.

According to Professor Rogers, the miocene marl district comprehends the area between the seaboard and a line conceived to be drawn through Northbury on the Pamunkey, and Coggin's Point on James River, (some six or eight miles below City Point,) in a direction nearly meridional. The eocene marl district is comprehended between the imaginary line thus described, and another line passing from the mouth of Aquia Creek, through Wales at the junction of the North and South Anna rivers, and thence through City Point. Its existence extensively beneath the miocene district was regarded by Professor Rogers as highly probable, and may now be considered certain, as a very thick deposit has been discovered by boring far down below the bed of James River, at City Point, and another at Norfolk, of great depth, in sinking an artesian well. West of City Point, however, and up to the line of granite at the falls of the river, a very good agricultural marl is found. It seems to have been deposited in estuaries of a former sea, and may be traced, at intervals, along the Petersburg and Weldon railroad, the Richmond and Petersburg road, and north of Richmond, in the same general direction, in the counties of Hanover, Caroline, and so on. In such places the beds lie near the surface, and are very accessible to farmers living along this boundary.

But it is the miocene district that is most signally favored by the richness and abundance of the marl deposits, and their general accessibility. In the upper or western portion the country is far from being regular.

It has rather an undulating surface, with an elevation above tide of from twenty to eighty feet; and, being penetrated by several large streams, the bluffs on their margins are cut up into numerous channels. It is along these channels, high above the water-line, and along the creeks and inlets subordinate to the great rivers, and back into the interior on the same level, that marl shows itself, of the finest quality and inexhaustible in quantity. It may not, indeed, be obtained on every farm sufficiently near the surface, but few neighborhoods are without it. Such, at least, is the case far down the rivers, until, approaching the extremities of the peninsulas, the country subsides into a vast plain, with a comparatively slight elevation above the water. Here the miocene marl disappears, which leads to the belief that it was washed away by the currents of a former sea. But the eocene strata, over which the miocene lay superimposed, still continue, though at great depths. In boring for water at Norfolk, thirty years ago, as previously referred to, shell marl was first struck at a depth of seventy feet, and there was no change in the stratum for seventy feet more, when the auger broke and the boring was discontinued.

On the eastern shore of Virginia no discovery of marl, as far as we have heard, has been made. But there are numerous banks of oyster shells—Indian banks, as they are called—on the margins of the creeks and inlets, supposed to have been accumulated by the aborigines before the discovery of the country. The shells are in a half decomposed state, and, as they readily disintegrate under the action of the plow, they are extensively used for agricultural purposes. In a district of such extent there are, as may well be supposed, several distinct varieties of marl, the most prominent of which may be described under the following classification:

1. *Blue marl.*—This is the kind that most abounds in the upper or western part of the district. It derives its appellation from the compact blue clay in which the shells are deposited, and by a stratum of which—usually four or five feet in thickness, but destitute of fossil remains, containing only "casts"—the beds are covered. This covering has to be removed before the marl can be rendered accessible. In favorable localities, for the beds are high above the water, a natural drainage of the pits may be readily effected; but, where the ground does not admit of this, the water must be kept down by pumping. The accumulation is seldom so great, however, as to render this a laborious operation, or to interfere materially with the working of the pits. The marl is raised by a sweep or other simple machinery, or, in places where the deposits are shallow, it may be cast out on the banks by hand. When first excavated it is very heavy, and the hauling to the fields is quite laborious; but planters who are prosperous collect a large supply on the banks of the pits, enough to suffice for the operations of a whole season. In the course of a few months the moisture is drained off from the mass, and the clay also loses much of its adhesion. It is, therefore, in a better condition to be hauled on the land, while the burden of hauling is materially lightened. This variety of marl is not so rich in calcareous matter as some others, containing, perhaps, on an average, not more than fifty per cent. of carbonate of lime; but the clay which accompanies it renders it highly useful in its application to arenaceous soils. The coloring matter of the clay is believed to be derived from the presence of minute particles of greensand, which, of itself, is a valuable ingredient in calcareous manures. The blue marl also contains crystals of gypsum, sometimes very numerous.

And here, though perhaps not strictly in place, it may be well to

describe the mode of transportation to the fields, and the usual quantity applied to the land, which is equally applicable to every variety of marl. Assuming an acre to contain, in round numbers, five thousand square yards, the field is marked off with a plow into spaces of ten yards each way, thus making fifty spaces to the acre. In the middle of each space five bushels are dropped. The boundaries being defined, it is easy to distribute with uniformity, and at any desired rate. Carts made expressly for the purpose, and of a capacity of five bushels, drawn by a single horse or mule, being provided, the work of removal goes bravely and systematically on: and with good, active drivers and sufficient teams, a large surface may be marled during periods of leisure.

This is marling at the rate of two hundred and fifty bushels to the acre, which is considered an ample dressing for any land not in a course of amelioration. On sterile lands, where there is little or no vegetation, it may be too much; and the effect would be to "marl-burn" the soil. But any land, however exhausted, may be improved by the addition of vegetable matter, such as woods litter, pine beards, &c. In places where the land has been thrown out of cultivation, and the old field pine taken possession, a large quantity of suitable material is cheaply and conveniently supplied by felling the growth, then lopping off the branches, and leaving the whole for a couple of years to decay. The marl should be previously spread over the surface that it may have the benefit of a more perfect disintegration by exposure to the air, though it may be done with nearly as good effect afterwards. In preparing for a crop, as much of the decayed vegetation should be turned in as the plow will cover. A great deal of land has, in this way, been restored from poverty to fertility.

When the shells are first taken from their beds they are in their natural shape, and possess a greater or less degree of solidity. But being mixed up with the soil by cultivation, and acted on either by the acids of the soil or the gases of the atmosphere, or both, they soon become thoroughly decomposed, and all visible trace of them is lost after a few years.

2. *White marl.*—In the peninsula formed by the James and the York River, and in several of the counties north of the York, are extensive beds of white, or pulverulent marl, very rich in calcareous matter; some specimens containing as much as ninety-five per cent., and generally not less than seventy-five or eighty per cent. of carbonate of lime. In these beds the shells are rarely found entire, and the condition of the fragments is such as to render it difficult to recognize the species of fossil to which they belonged. The marl presents an appearance not unlike an impure chalk. In places, however, it is mixed with a large proportion of white clay and sand, so nearly the same color as to make it difficult to distinguish between them without the application of chemical tests.

3. *Greensand marl.*—This abounds in the vicinity of the Pamunkey River, in the counties of Hanover and New Kent, and is perhaps the most beneficial in its action on the soil of all the varieties of fossil deposits. Besides carbonate of lime it contains potash, phosphorus, and not unfrequently ammonia. When the agriculture of Virginia was in a flourishing condition, the evidences of improvement were particularly conspicuous in that part of the State where this kind of marl is found.

4. *Ferruginous marl.*—In some localities the shells are deposited in a yellow or ochreous clay, which, doubtless, derives its color from the proximity of ferruginous matter. The beds in some cases are not more difficult of excavation than those of the blue marl, and the effect on the land

is very much the same. But in other localities they have become indurated and are broken up, not without considerable labor. In its texture this marl sometimes bears a resemblance to a secondary limestone, but, in the opinion of Professor Rogers, it is properly a tertiary limestone. It is found in fragmentary masses along the cliffs of York River on the southern bank, and particularly abounds in the neighborhood of Yorktown. It shows itself above the water-mark, and in precipitous places the surface has been scooped out by the action of the weather, assisted perhaps by artificial agencies. At Yorktown, for instance, there is an excavation, known by the name of Cornwallis's Cave, which tradition represents as having afforded a refuge to the commander of the British forces, at the time of the memorable siege of that place. This rock was used to some extent in colonial times as a building material, but it has not been found to possess the requisite solidity. It contains a large percentage of carbonate of lime, and might, therefore, be converted, by burning, into a valuable agricultural lime. A specimen of the cliff at York, according to an analysis by Professor Rogers, yielded 87 per cent. of calcareous carbonate; and, computing the quantity of caustic lime corresponding to this, he estimated that a hundred pounds of the shell rock would yield 48.7 pounds of strong lime. We have no knowledge of its having been burned, but from the abundance of fuel in the vicinity it might, without doubt, be converted into a lime useful both for agricultural and building purposes. The use of marl was seriously interrupted, not to say suspended, by the war, nor has it since been resumed to any great extent. But it is beginning now to come in request again, owing more perhaps to the increasing cultivation of peanuts than to any other cause. This crop will only come to perfection on highly calcareous soils, as otherwise the pods, however luxuriant may be the growth of vines, do not fill. According to present indication the peanut will soon become the leading crop in Eastern Virginia. From the great number of persons intending to engage in its culture during the coming season, the presumption is reasonable that the use of marl will receive a fresh stimulus, such as has not been witnessed for the last ten years.

Owing to its great weight, it has not been found profitable to transport marl beyond short distances. The white variety, being the richest and less encumbered with clay, has been lightered from one locality and even from one county to another. This was when its use first excited a general interest. Subsequently, however, it was found more economical to those who had no marl deposits on their estates to purchase what was generally known as agricultural lime, vast quantities of which came in the course of time to be taken by farmers living on the margins of the navigable streams, at whose landings it was delivered in bulk. A regular trade was kept up, for instance, between the James River and the Hudson, farmers usually paying by the cargo from seven to eight cents a bushel in its powdered state. Since the war, very little of this traffic has been going on, for which two reasons may be assigned: first, that farmers are not yet in a situation to make large investments for the progressive improvement of their estates, and second, shell lime is furnished in sufficient quantity to meet the present demand. This is supplied chiefly from Norfolk, where oyster shells accumulate in immense quantities, and is thence distributed to the inland towns, and to such interior portions of the country as are rendered accessible by lines of railway. This also goes under the general name of agricultural lime. It is the purest form in which lime can be obtained, and is sold at the kilns either by measure or weight, say twelve and a half cents a bushel

or five dollars a ton. This would make the first cost reasonable enough, but it cannot be less than doubled after adding the expenses of transportation to a distance. But though possessing a larger percentage of calcareous matter than stone lime, yet nothing of the kind ever acted better on our soils than what was formerly brought from the North River, being, with the exception of sand, free from all extraneous ingredients, such as magnesia, which is found in so large proportion in the Washington lime, rendering it oftentimes hurtful instead of beneficial to the land. Whenever the lands on our river borders shall be brought again into extensive cultivation, the North River lime will doubtless come into as great request as formerly.

It would be doing injustice to the name of a distinguished agriculturist and a man of genius to withhold in this connection a reference to the labors and experiments of the late Edmund Ruffin. His fame is, in fact, indissolubly associated with this subject, for he was the pioneer in the work, devoting for years a mind of extraordinary activity to efforts, both by example and precept, directing public interest in this channel of improvement. A small number of experiments had been made in marling in James City County, as early as 1816, or perhaps earlier, but without being conducted with any intelligent purpose. In ignorance of these, however, Mr. Ruffin made his first experiment in 1818, to the trial of which he was led altogether by theoretical views and by reasoning on the supposed constitution of the soil, as well as the known constitution of the manure. This was on his farm at Coggin's Point, on James River, in the county of Prince George. It extended over an area of about fifteen acres, but by 1821 the area was increased to eighty acres, and was subsequently continued, until within a few years all the arable land on the farm, say six hundred acres, was thoroughly marled. The result was marvelous, and soon had the effect of stimulating others to engage in the work, until the practice of marling became general among intelligent farmers throughout tide-water Virginia. In all cases wherein any thing like an ameliorating rotation was followed, the crops were quadrupled and the land put into a course of permanent improvement. Proverbially slow as agricultural progress has ever been, yet in the course of forty years, from a very small beginning, a vast revolution was effected, and all through the agency of one man of comprehensive views and untiring energy, whose services in a noble pursuit entitle him to rank as a public benefactor.

Mr. Ruffin's writings on the subject of marl were quite voluminous. For ten years he conducted the *Farmers' Register*, an agricultural journal, issued monthly at Petersburg from 1833 to 1843, in which the subject of marl occupied a prominent place. But his fame as a writer is chiefly built on his *Essay on Calcareous Manures*, an octavo volume of three hundred pages, which took position as a standard work immediately on its publication.

THE LIMESTONE REGION.

Limestones occupy the valley of Virginia throughout its length and breadth. Some of them are of great purity and yield limes equal to any from the north. Some, too, when burned and ground, yield admirable hydraulic cements. These last, however, would not make limes suited to agricultural purposes. Limestones also occur in several places west of the great valley. The Warm Spring Valley is a limestone formation, and large areas in Highland County are covered with it; while still further west, in what are now the border counties of West Virginia, lime-

stones, the same that make Kentucky so great a grazing country, abound almost everywhere, and impart to this whole section its distinctive feature as one of the finest grazing countries in the world.

It would seem, from all we can gather, that very little lime has been used in the valley as a fertilizer. But it does not follow from this that applications of lime to limestone lands are not beneficial. On the contrary, the almost universal use of lime in Lancaster and other limestone counties in Pennsylvania, where high farming is the rule rather than the exception, demonstrates its great value in promoting the fertility of the soil. The experience, indeed, of some of our own valley farmers, who have used lime, goes to prove the same thing. East of the Blue Ridge, in what is termed the Piedmont division of the State, a belt of talcose and mica slate, of varying width, traverses the counties of Fauquier, of Culpeper, Orange, Louisa, Albemarle, Buckingham, Nelson, Amherst, Campbell, Pittsylvania, and Franklin, following a direction mainly parallel to the mountain crests, and consequently running northeast and southwest. A line traced on the State map from the mouth of Summerduck Run, on the Rappahanock, through Orange Court House, Gordonsville, Warminster, on the James, to the mouth of Archer's Creek, and prolonged to the southwest into Franklin County, would indicate approximately the position and direction of this belt of talcose rocks, which accompanies the limestone. The limestones occur somewhat irregularly along this line, interrupted or in layers; not continuous, but outcropping at various places where they have been quarried either for building or burning to lime. From a short distance above Scottsville up nearly to Lynchburg the James River meanders through this belt, and consequently we find the limestone exposed at numerous points along the river, and favorably located for quarrying and water transportation. If lime suitable for agricultural purposes can be obtained from it, this calciferous belt, running through a section the soils of which are as a rule deficient in lime, must prove an incalculable blessing to farmers. Various analyses of these limestones, made by Professor Rogers while State geologist, demonstrate their value for all the purposes to which lime may be applied. Considerable variation in the constituents are reported in specimens from different localities, some yielding a lime of excellent quality, some being true hydraulic limes, while others contain a considerable proportion of magnesia. How far the presence of this mineral may affect its value for agricultural purposes the writer is not prepared to say. A belt similar to the one described traverses the northwest side of Fauquier and Loudon, lying along the west side of Bull-Run Mountain. At several localities in this belt the limestone has been burned, and is said to have yielded lime of good quality for building purposes, but we have no information that it has been used as a fertilizer.

It is within the recollection of the writer that the owners of limekilns along James River, at its intersection with the belt above described, were at one time ready to make contracts with the farmers living below for the delivery of agricultural lime at their landings on the canal. Only a small quantity, however, was taken, and no valuable result was ever reported. It was believed that the soils near the river did not require it, and thus the use of lime throughout the district, from the Blue Ridge to tide-water, seems to have made no progress whatever. At the same time the soils are believed to be destitute of any calcareous ingredient, while a portion of them evidently comes under the head of "acid" soils, according to the nomenclature of Mr. Ruffin, as is indicated by the growth of sorrel, broomsedge, huckleberry bushes, old-field pine, and

other sour plants. But generally the soils of all this region are highly improvable, resting for the most part on a basis of red or yellow clay. The red soils of Albemarle and Goochland are proverbial for their fertility. Clover grows well wherever the land has not been exhausted, and plaster has a fine effect. Should lime ever become accessible at a moderate cost, this may be made one of the finest, as it is one of the most salubrious, districts in the State.

According to all analogy we should expect to find limestone accompanying the coal measures of Chesterfield, Henrico, and Goochland. But not a trace exists, with the exception of a thin crystalline deposit of pure carbonate of lime, resting immediately on the granite which forms the bed of the coal basin. This extensive coal-field is thought by geologists to have been deposited long subsequent to those of other coal districts, and therefore not properly belonging to the carboniferous era. It affords the only instance, it is believed, in which the coal is superimposed immediately above the granite. This is not uniformly the case, however, on account of the frequent and violent dislocations that are found to occur in every part of the basin yet explored, and which in the sinking of a shaft render the striking of a seam as much a matter of chance as of science. Thus far, coal has been raised only on the eastern and the western boundary of the basin, which is from eight to ten miles in width; and, from the great dip of the strata, it is hardly possible it will ever be raised from the middle, not even by means of drifts. Already there are numerous pits from seven hundred to eight hundred feet deep within a mile of the outcropping.

The fine coal which accumulates at the mouths of the shafts has been used for agricultural purposes, and not without benefit. But the effect is perhaps only mechanical, by improving the texture of heavy soils, or contributing to the warmth of those which are cold by a freer admission of the sun's rays.

PLASTER.

The only extensive deposit of gypsum in the State, as far as we have any knowledge, is situated in the extreme southwestern portion, in the counties of Smyth and Washington. It is found in the valleys of the North Holston River and of Walker's Creek, between Walker's Mountain and Clinch Mountain, and stretches along these valleys for forty miles in a nearly east and west direction. The plaster occurs as boulders, some of which are of immense size, imbedded in clay. The deposit is believed to have great depth, and practically it may be regarded as inexhaustible. The beds have not been worked to any great extent, though enough has been taken out to supply the wants of the surrounding country. It has found its way also along the Virginia and Tennessee railroad as far as Liberty, in Bedford County, and from this and other points on the road over the mountain into Botetourt, and some is sent in boats down the Holston River. There can be no doubt that with convenient access to a market by railroad or water, with transportation at reasonable rates, the whole State, above tide water at least, could be supplied with plaster at prices considerably less than for Nova Scotia plaster. The beds are several miles from the railroad, so that at present the plaster has to undergo the expensive process of hauling in wagons; but it is understood that efforts are being made to get a branch road, or tram-way, to the banks. An analysis by Professor Gilham makes this plaster equal in all respects to the Nova Scotia.

CONCENTRATED FERTILIZERS IN THE SOUTHERN STATES.

THE PECULIAR WANTS OF SOUTHERN AGRICULTURE.

Cotton planting, the product of which is largely exported and which demands constant tillage, and the occasional heavy rains falling on light plowed ground easily washed, tends powerfully to denude and impoverish the soil. As no cotton, grain, or tobacco can be raised without cultivation, and frequent heavy rains are as distinctive in their character as any other feature of our climate, fertility can be maintained in long-cultivated fields only by restoring to the soil in some way the elements of crops removed partly by washing rains and partly by fertilizing atoms consumed in the growth of cultivated plants. Hence, planting industry in a semi-tropical climate requires for its highest usefulness and success far more manure derived from sources outside of the plantation than ordinary farming, or mingled grass and grain culture with stock husbandry. Under the latter system the farmer has superior advantages for the home production of fertilizers from live stock, that give a profit independent of their manure. Fields seeded to permanent grass or in clover are generally exempt from injurious surface washing, while all the fertilizing substances contained in a rich turf, and in the valuable roots, stems, and leaves of clover, are drawn, in part at least, from the atmosphere and the deep subsoil. To exclude from cotton plantations all clover, grass, culture and stock growing is not wise, unless one may command at a low price concentrated commercial manures that will at once maintain the fruitfulness of every field and return a satisfactory profit. Commendable efforts have been made, and are still in progress and increasing, to supply manures of this character. They are essentially such elements of fertility as disintegrated rocks yield to the best clay, sand, and soils. Such plant-food as rain water and the atmosphere supply over every poor field as generously as over these most productive, are to a large extent left out. Concentration means the exclusion of all atoms in manure that experience proves to be of less value than those retained. A fertilizer that has no greater value, pound for pound, than common yard and stable manure, will not bear long and expensive transportation, if the planter obtained it in the first instance for nothing. Concentration, therefore, is a matter of the greatest practical importance where land by the hundred million acres, remote from commercial centers, is to be fertilized by commercial manures. As far as the planter, farmer, or stock raiser sends a bale of cotton, barrel of flour, or fat steer to market, which takes from the soil a part of its indispensable phosphates, sulphates, potash, and other bases, the principle of restitution should be applied and compensation made, if need be, by the return of the fertilizing substances named. A nation of farmers and planters who cultivate poor land without manure must, from the necessities of the case, support half of its entire population in poverty, ignorance, and a low standard of material and moral comfort. Unproductive labor enriches no one, while it denies that "hope of reward" which is the very life and inspiration of happy indus-

try. A nation heavily in debt can ill afford to cultivate land too poor to return more than a bare subsistence to the millions that live upon it: and it is still worse economy to impoverish, from the lack of manure, the fruitful lands that remain to us of our noble inheritance. Not only our cotton growing interest in the South, but our wheat and corn growing interests everywhere, demand the raw material for making crops at the cheapest rate it can be furnished by the best talent, science, and art in the country. Let us examine some of our resources in the planting States to supply the essential food of plants.

SALTPETER CAVES IN THE SOUTH.

It is a historical fact of no inconsiderable agricultural importance that, during the last war with Great Britain, when our coasts were blockaded, saltpeter was made for gunpowder from the nitrate of lime taken from the Mammoth Cave in Kentucky. Similar caves, but less in extent, in North Alabama, Middle and East Tennessee, and Virginia, furnished a large but unknown quantity of this nitrate during the recent civil war. One of these niter-producing caves exists on the farm of Dr. Lee, about twenty-five miles below Knoxville, and another on the farm where he resides, near the French Broad River, in Knox County. The successful use of nitric acid, in combination with potash, soda, lime, and magnesia, as a fertilizer, leaves no room for doubt that a pound of nitrogen in this form is not less valuable as plant-food than an equal weight in the form of ammonia. Therefore, whoever can produce the nitrate of lime, in a cave or elsewhere, may produce the most valuable constituent in Peruvian guano, an imported manure worth eighty dollars a ton in Baltimore, and ninety-five dollars a ton in several southern cities. Deprive this expensive manure of its nitrogen, and its market value will fall at once to less than half of its present price, although the average quantity of nitrogen contained in it does not exceed twelve per cent.

As a source of assimilable nitrogen, nitrification is a matter that well deserves the study of every planter and farmer. It is not more certain that common mold and toad-stools grow on a dung heap than that saltpeter will grow at the expense of atmospheric nitrogen and oxygen, under favoring conditions. Nitric acid probably exists more abundantly in Chili and Peru, in combination with soda as cubic-niter, than in any other countries; and it is found under conditions that forbid the idea that the acid has a vegetable or animal origin. Nitrification appears to resemble combustion, with this difference: carbon, hydrogen, sulphur, and phosphorus, burn and form acids without the aid and presence of any base to unite with the acid generated; while the combustion of nitrogen with oxygen requires the aid of a present alkali or alkaline base to combine with and take up nitric acid as fast as it is formed. Decaying animal or vegetable matter liberating nascent nitrogen in the presence of lime in our caves, of soda in Chili, and potash in many places, may be, and probably is, necessary to start the formation of nitric acid; but nitrification once going on, with an abundant supply of oxygen and nitrogen present, and lime greedy to consume the acid as soon as formed, much more niter appears in the result than the organic matter will account for by the nitrogen supplied. Precisely what varying conditions extinguish the chemical action called nitrification are not known. The subject loses some of its practical importance on limestone land, from the fact that with clover and a little plaster we can draw assimilable nitrogen directly from the atmosphere cheaper in

all our fields than we can produce it in caves or elsewhere, to be used as a manure. The consumers of Peruvian guano pay more for assimilable nitrogen than it is fairly worth. Bringing nitrogen from Peru to this country and Europe for manure is about as wise as the transportation of brick from Holland to build houses on the clay banks of Albany, New York, and from England for a similar purpose in the colonies of Virginia and Maryland. On non-calcareous soils the nitrate of lime may be used at a large profit. It is worthy of remark that, in the absence of an alkaline base, nitrogen liberated from decaying substances unites with hydrogen to form one (ammonia) in preference to combining with oxygen to form an acid. The chemistry of the dung-heap and of all agricultural salts is alike inviting and instructive, and it is strange, or at least unfortunate, that planters and farmers who invest thousands in *acids* and *alkalies* for manure every year, are so unwilling to study their mutual affinities, origin, and agricultural force. The action of lime in saltpeter caves suggests its use in composts, on the farm, and as a fertilizer in the soil everywhere. If lime in rocks and soils does not augment fruitfulness, why are the limestone districts in Virginia, Kentucky, Tennessee, and Alabama (not to name those in New York, Pennsylvania, and Ohio) so remarkable for their fertility? Lime as the base of an acid will convey into the circulation of agricultural plants carbon, nitrogen, chlorine, sulphur, and phosphorus; but all these elements of crops must be in the soil, within its reach and in an available form.

Having briefly noticed nitrogen in connection with lime as a fertilizer, phosphorus will next be considered as it is found in—

THE BONE PHOSPHATES OF SOUTH CAROLINA.

There is reason to believe that the richest deposit of bone phosphates on the continent, and, as far as known, in the world, exists in South Carolina, not far from Charleston. Dr. Pratt, of that city, whose analytical researches developed the full value and significance of this wonderful mine of phosphoric acid, says:

"This bed has long been known in the history of the geology of South Carolina as the 'Fish-bed of the Charleston basin,' on account of the abundant remains of marine animals found in it; Professor Holmes, of Charleston College, having not less than 60,000 sharks' teeth alone, some of them of enormous size, weighing from two to two and a half pounds each. The bed outcrops on the banks of the Ashley, Cooper, Stono, Edisto, Ashepoo, and Combahee Rivers; but is developed most heavily and richly on the former, and has been found as far inland as forty or fifty miles. Near the Ashley River it paves the public highways for miles; it seriously impedes and obstructs the cultivation of the land, affording scarcely soil enough to hill up the cotton-rows; and the phosphates have for years past been thrown into piles on the lawns and into causeways over ravines, to get them out of the reach of the plows. It underlies many square miles of surface continuously at a depth ranging from six inches to twelve or more feet; and it exists in such quantities that from five hundred to a thousand tons underlie each acre. In fact, it seems there are no rocks in this section which are not phosphates."

From these fossil bones and teeth the Wando Mining and Manufacturing Company of Charleston have made, with other ingredients, a fertilizer, which is sold at sixty dollars a ton, which proves, in many instances, equal in value as a manure to Peruvian guano that costs

eighty dollars a ton. Others are successfully manufacturing soluble phosphates from these organic remains. Bones of fresh-water animals, and still more, perhaps, of land animals, are found with those grown in salt water. Indeed, there is no reason why this great "Fish-bed of the Charleston basin," as Professor Agassiz named it more than twenty years ago, should not supply soluble phosphoric acid in its most available form; for the bones of the mastodon still retain some two and a half per cent. of their organic matter, and yield on analysis eighty-five per cent. of bone phosphates. Restore the fat, gelatine, water, and carbonate of lime that existed in these organic bodies when the animals died, and the phosphates will be reduced from eighty-five per cent. to about fifty-five per cent. Time has eliminated elements of little value as plant-food (except nitrogen) in fresh bones, and thereby concentrated phosphorus into a smaller volume for distant transportation and use as a manure.

After citing the results of thirty analyses of as many samples of these extensive deposits, some nodular, hard conglomerates, once thought to be silicious fossils, and some the soft *débris* of bones, with a part of the organic matter still remaining, Dr. Pratt sums up their advantages in these words:

"1st. The percentage of the phosphate of lime is high. 2d. The carbonate of lime and phosphate of iron and alumina are unusually low. 3d. Its composition is more uniform and regular than that of any other known stratum of a similar nature. 4th. Its mechanical or physical qualities are such that it is easily ground. 5th. It contains no mineral phosphate, but is without doubt purely *animal* in its origin.

"With these immense advantages in its favor, we may fearlessly throw it on the market, and feel that in one other product, besides cotton, rice, and lumber, we are independent of the world."

A citation indicative of the extent of this available mass of bone earth, in addition to those above given, may satisfy cautious readers. The same author states in another place, that "the area of this bed containing phosphates of good quality, and in workable quantity, so far as known and examined by the writer in person, is not less than *forty or fifty square miles;* though from samples I have examined from beyond these limits, I am led to believe that the rock will be found of good or indifferent quality, and in greater or less quantity, over an area of several hundred square miles."

So large a supply of phosphorus of animal origin in or near the center of the best cotton-growing country in the world, whether long staple or short, is a fact hardly less important in its financial, commercial, and manufacturing aspects than in its agricultural significance. Nothing will contribute so much to keep the nation's large and growing foreign trade in a safe and profitable condition, yielding an immense revenue by import duties, as the cheap production of cotton under a system of tillage and plantation economy that will impart a high degree of fruitfulness, in perpetuity, to all our planting lands; as naked, gullied, abandoned old fields, they are valueless; but with good concentrated manure, easily drilled in with cotton-seed, they often return an annual profit of from \$10 to \$100 per acre; crops ranging from five hundred to a thousand pounds of good merchantable cotton are raised by the aid of commercial fertilizers. At twenty cents a pound, the profits are most satisfactory to the planter and manufacturer of superphosphates.

Dr. Pratt's "Chemical History" of South Carolina phosphates has the following tables, on pages 20 and 21:

Tabulated results of analyses made in the months of August and September, 1867, together with a few analyses of other chemists, for comparison.

	1	2	3	4	5	6	7	8	9	10
Phosphate of lime	31.40	55.52	63.30	68.03	66.36	61.93	64.07	69.00	59.07	49.35
Phosphate of iron and alumina	......	1.50	1.32	5.02	3.01	1.04	0.84	......	.65	1.84
Carbonate of lime and magnesia	......	10.33	8.20	8.03	......	11.21	11.00	......	5.68	25.70
Organic matter	......	6.50	......	7.50	......	......	......	......	......	......
Sand	29.32	10.31	9.01	9.91	11.70	......	......	......	......	......

Alkalies, magnesia, sulphates, chlorides, fluorides, water, &c., not estimated.

	11	12	13	14	15	16	17	18	19	20
Phosphate of lime	49.87	50.07	61.24	85.65	46.00	40.28	70.90	60.80	15.86	44.70
Phosphate of iron and alumina	0.86	0.69	......	......	......	......	8.50	4.10	13.91	......
Carbonate of lime and magnesia	4.73	10.14	8.60	5.04	4.00	5.32	10.28	23.70	39.50	11.36
Organic matter and water	......	......	30.16	2.16	48.00	40.64	4.00	6.10	11.60	5.00
Sand and loss	......	......	......	......	......	13.76	5.79	1.60	10.60	27.90

	21	22	23	24	25	26	27	28	29
Phosphate of lime	40.34	49.12	62.26	43.90	53.20	63.61	51.50	44.00	31.06
Phosphate of iron and alumina	......	12.00	......	12.33	9.23				
Carbonate of line and magnesia	14.84	......	......	......	......	......	......	......	......
Organic matter	2.13	......	17.31	22.81	18.24	11.36	21.51	18.31	18.60
Sand and water	25.44	......	......	15.40	4.08	18.95	12.07	35.60	43.17

HOW TO UTILIZE BONE PHOSPHATES.

When separated from all impurities, by washing or otherwise, as far as practicable, phosphates should be broken fine enough to grind between heavy millstones, which should be dressed to do as perfect work as possible. The finer the flour is ground the easier its particles dissolve in any acidulated water. Thorough drying before grinding favors extreme comminution when reducing the rock to powder. How far heat may be profitably carried to aid in the complete disintegration of bones or bone phosphates, experiments will determine. When properly ground the fertilizers may be handed over to farmers and planters for solution in that admirable crucible known as a hot, fermenting dung-heap.

It is true that the sulphate of lime obtained by treating ground bones or guano with oil of vitriol is valuable as a manure; but gypsum will supply the same fertilizer at less than half the cost of the vitriol. Economy demands that cultivators of the soil purchase sulphuric acid in the shape of land plaster, not in the form of a separate acid, as applied to bone phosphates. But as some families buy wheat flour after it is baked into bread, so many farmers may prefer to purchase plant-food ready cooked for use.

A late number of the Journal of the Royal Agricultural Society of England contains an elaborate paper "On the solubility of phosphatic materials with reference to the practical efficacy of the various forms in which bones are used in agriculture," by Dr. Voelcker, chemist to the society. His researches have been thorough, and are reliable. He says: "High-pressure steam renders bones so brittle that they can be easily ground into fine powder, which is readily assimilable by plants."

This is all that any plants need in a manure. He continues:

"Bone-meal prepared by high-pressure steam contains not much less nitrogen than ordinary bone dust, and as a manure is far more efficacious and valuable than the latter. Placed in a heap with ashes or sand, and occasionally moistened with liquid manure or water, bone enters into putrefaction, and becomes a more soluble and energetic manure than ordinary bone dust. An excellent way of making bone dust soluble, it may also be mentioned, is the Norfolk plan of putting it into alternate layers between fresh farm-yard manure, and letting both ferment together in a conical heap, covered up with earth, to prevent the loss of any fertilizing matter, and secure it from penetration by heavy rains."

Norfolk farmers have long been distinguished as the best in England, which is equivalent to saying they are the best in Europe, and in the world. While many thousands in Great Britain, on the Continent, and in America, use expensive sulphuric acid to dissolve bone phosphates, Norfolk farmers accomplish the same result by warm carbonic acid, water, and nitrogenous substances in fermenting manure. At the market price of sulphuric acid in the South, planters now pay as much for one pound in superphosphates as ten pounds of the South Carolina bone flour ought to cost at the mills where it is ground. The chemistry of plant and animal food and nutrition will never do much for agriculture before the true economy and principles of this science are carried home to the fireside and understanding of the men who own and cultivate the soil. Farmers, who are large consumers of acids, alkalies, and alkaline earths, ought to study all their chemical relations in compost heaps, soils, plants, and animals. Every farmer and planter should be able to inquire understandingly in what way nature dissolves the apparently insoluble carbonate of lime, phosphate of lime, and silicate of potash in soils, to promote the growth of plants. There is no reason to believe that sulphuric acid is in any way applied to that object. Carbonic acid, and others of vegetable origin, are sufficient for the purpose. Water charged with carbonic acid (the cheapest acid known) dissolves the carbonate of lime freely, acts sensibly on the silicates of lime, potash, and soda, and on bone phosphate reduced to a fine powder. Strong vinegar can be made from sorghum sirup, and used as a solvent on the farm cheaper than sulphuric acid can be bought and used for agricultural purposes. In a word, the same organic acids formed in decaying dung-heaps and in good soils, that render the mineral elements of crops available, as obtained from particles of feldspar, mica, hornblende, and other compound minerals as they exist in clay and sand, are at the service of the farmer to bring South Carolina bone phosphates into solution. Give us the osseous remains of extinct vertebrated animals as pure, as finely ground, and as cheap as possible, and southern planters and farmers will do all else that is needful to reorganize them as parts of living beings.

THE SOURCES OF PHOSPHORUS AND SULPHUR IN SOILS.

While commercial enterprise explores every sea to find islands and rocks covered with the excrements of birds to be imported and used as manure; and while geologists and chemists search earnestly in the beds of post-pliocene rivers, lakes, bays, and estuaries for the bones of land and sea monsters developed in an age when oysters in Georgia built up banks of their shells two hundred feet in thickness, with specimens still found one hundred miles from the Atlantic, that measure from eighteen to twenty inches in length, and elephants, mastodons, crocodiles, and

sharks attained a growth still more incredible, farmers should have sufficient ambition and professional pride to look into their own soils, subsoils, and rocks for a home supply of phosphorus, sulphur, potash, and other substances, without which no crop can grow. In the Patent Office Report for 1850 may be found an essay of nearly a hundred pages on the "Study of Soils," in which all the elements of cultivated plants are traced to their source.

Phosphorus and sulphur in combination with iron, as a phosphoret and sulphuret of this metal, often abound in soils—a condition in which they do no good as plant food. The earthy part of every seed of wheat has from seventy-five to eighty per cent. of phosphoric acid and potash as necessary constituents; and while the soil has a plenty of phosphoret of iron and insoluble silicate of potash, the lack of available phosphoric acid and potash often reduces the yield more than one-half. Crops of corn and cotton are also diminished under like circumstances, when their elements, although present, are unavailable. All such lands need marl or lime, by which the phosphorets and sulphurets of iron are changed, or rather made to produce gypsum and bone earth. The phosphate of alumina is decomposed also by lime, yielding a bone phosphate. Sulphur in combination with iron is converted into an acid by lime, with which it unites to form the sulphate of lime, which is best known as gypsum or land plaster. The power of lime to produce both phosphoric and sulphuric acids in soils where neither existed before, gives to the marl beds which extend from the Chesapeake Bay to the Rio Grande great agricultural importance. Lime often eliminates potash and magnesia from their insoluble silicates in a similar manner. Clay roasted with lime gave Dr. Voelcker about twice as much potash to rain-water as that roasted without lime. It is impossible to account for the greatly increased growth of walnut, hickory, and poplar forest trees on our own limestone lands, which contain fourfold more potash and magnesia in their cells and tubes than smaller trees have that grow on similar clays nearly destitute of lime, without conceding the power of this alkaline earth to decompose the silicates of potash and magnesia as derived from their parent rocks, and thereby supply potash and magnesia as well as lime to these magnificent plants. The fertility and general durability of our best lime soils are well known; yet lime is not potash, nor magnesia, nor chlorine, nor soda, nor sulphuric, nor phosphoric acid—all of which appear in our annual crops of grain, grass, and other staples. Lime eliminates these from insoluble minerals as naturally as it forms the stone-like covering of all shell-fish, and the base of all internal skeletons. Its relations to plant life and animal life may be obscure, but they are obviously most intimate and enduring, commencing with some of the oldest sedimentary rocks, which, in the Allegheny range of mountains, Professor Rogers estimates at 40,000 feet in thickness. During all the unknown and apparently almost unlimited geological ages in which these mountains of sea-born rocks have been slowly growing, and serving as the cemetery of expiring species and genera of animals, as well as of individuals, these beings have used lime to cover all their shells, and to give solidity and strength to every bone in their bodies. An element of fertility used by nature so largely and enduringly, thinking farmers will not long neglect.

CALCAREOUS MARLS AND POTASH GREENSANDS.

No owner of a naturally poor clay or sandy farm on the Atlantic slope of the United States can visit the rich calcareous soils to be found in

many of the western and southern States without wishing to try the efficacy of lime, marl, or greensand for the improvement of his comparatively sterile land. Governor Hammond has applied some 300,000 bushels of shell marl from Shell Bluff, on the Savannah River, in Georgia, to his plantation at Silver Bluff, on the South Carolina side of the same river, with entire satisfaction. Mr. H. Burgwyn, of Northampton County, North Carolina, (a large and successful farmer,) says that "no gold mine is so valuable as a good marl pit." The late Thomas Affleck writes:

"Lime is an absolutely indispensable ingredient in the soil in which fruit-trees of any kind are grown, and especially the apple and pear. Until I was convinced of this fact, I found great difficulty in producing a healthy and vigorous growth upon many varieties of the apple. By *marling* I removed the difficulty; the wood became short, jointed, and healthy, the foliage abundant and persisting until frost, the fruit large, sound, and free from specks and blemishes, such as before disfigured some kinds."

Twenty-two years ago cotton sold in Augusta, Georgia, at five cents a pound, and fresh land in the southern and southwestern parts of the State could be bought at ten cents an acre. The price paid for cotton was too low to do more than return small wages for the labor of raising it on rich land, *without restitution*. Hence planting-lands, whether rich or poor, sold at mere nominal prices. Now cotton is worth at least fifteen cents per pound in gold, and the raw material for making it more than five times its value in 1847. Whatever concentrated fertilizers may be extracted from marl, and the greensands ot New Jersey, and in States south of it, have an excellent home market, which time is more likely to increase than diminish.

The greensands of New Jersey are so extensive, and so rich in potash, that nothing is hazarded in saying that millions of tons of this alkali exist therein, which science and art may yet extract, perhaps very much as common wood-ashes are made to give up their soluble potash for domestic use and commercial and manufacturing purposes. It is more than probable that many unsuccessful attempts were made to extract good commercial pearlash from wood-ashes before any one could claim success; but these repeated failures did not prove that all efforts in that direction must end in failure. Southern agriculture wants a vast amount of potash, which greensand contains in quantities apparently inexhaustible. As farmers and planters we do not need, nor want, the silicious sand, nor the alumina, nor the iron, nor the lime that may be found in the same bed with potash. Throw out these, and we will pay a fair price in cotton, wheat, corn, meat, and tobacco for the precious alkali.

Good marls so abound in the States of Maryland, Virginia, North Carolina, South Carolina, Georgia, Alabama, Florida, Mississippi, Louisiana, Texas, and Arkansas, all of the same geological age and formation, (the *pliocene* of Lyell,) that their presence or absence on the ground or under its surface is mainly a question of elevation above tide-water. Within five miles of Washington City, and a little north of the Marlboro' road, in a gully, may be seen the outcrop of a stratum of oyster and other shells of unknown extent and thickness. These marine shells are estimated to be over one hundred feet above the water in the Potomac. The hills of giant oyster shells that extend from Shell Bluff, on the Savannah River, thirty miles below Augusta, westward several miles, are one hundred and fifty feet above the Atlantic, and over one hundred miles from it. Between this remarkable mass of shells, generally quite free from sand and clay, and the Keys of Florida, a distance of some five hundred

and fifty or six hundred miles, there may be many "fish basins" filled with phosphates. We do not know what organic remains there may be in such large and true basins as that of the Okefenoke swamp, which covers an area of 500,000 acres, and in other swamps in southern Georgia and the peninsula of Florida. If dried peat, or any species of aquatic moss, is worth anything for fuel when pressed and dried, the great swamps of Georgia can supply almost any quantity. It is found on analysis that they contain from five to ten per cent. of ash and earthy matter. Hanging moss on cypress and other forest trees has about one per cent. of ash, half of which is lime. One hundred pounds of dry Okefenoke muck will take up without dripping nearly four hundred pounds of the urine of cattle when used as bedding. By drying the water out under a shed, and again saturating the muck with urine from a tank, repeatedly, a very concentrated mass of agricultural salts may be cheaply obtained. On thousands of plantations the leaves of forest trees growing in *low grounds* will supply salts of lime, potash, and magnesia cheaper than they can be bought in any market. These decaying with marl, gypsum, finely ground phosphates, and a sprinkling of common salt, give a valuable fertilizer at a moderate cost. Direct research shows that twelve times more of the mineral food of plants exists in one hundred pounds of the leaves of the long-leaf pine than in a like weight of the wood of this abundant forest tree. There is not a tree, nor a spring of water, nor a swamp, nor a brook on any farm that will not yield cheap manure. The water-shed of the Mississippi River drains an area of 1,100,000 square miles, from which a vast amount of agricultural salts is annually washed into the Gulf of Mexico. Judicious irrigation will save much of these salts for manure.

SALT FROM SEA-WATER AS A FERTILIZER.

In many places sea-water is so easily evaporated by the sun, as at the Keys of Florida, and along our southern coast, at Turk's Island, and elsewhere, that salts of soda, lime, magnesia, and perhaps potash, may be had for manure at a low price from this source. What but a lack of enterprise, or a want of knowledge on the subject, prevents the ocean from giving back to our washed and impoverished fields even more fertilizing salts, because more concentrated, than heavy rains, much plowing up and down hills, and other follies, ever washed into the sea? The sulphates of lime and magnesia, and the chlorides of calcium and other bases, which are much in the way in the manufacture of pure salt, will add materially to its value as a manure. If good Turk's Island salt can be made at from six to eight cents per bushel, as is stated, salt for fertilizing the soil, or for the "dung heap," can be produced at five cents per bushel. A demand for salts of this character will soon lead to an adequate supply, for the ocean is inexhaustible. It teems with animals and vegetables, and its waters abound in their food. The same elements that make the bones, flesh, blood, and milk of whales will do as much for our cattle and ourselves. The lime that protects bivalves from injury, and the sulphates, phosphates, and chlorides organized in marine animals and plants, are just as useful to our farms before as after this service in salt water. This water is really very rich in soluble manure. Why not evaporate the water and apply the manure to all our needy fields? Salt for the land and the dung heap is what farmers need; that is, salts of lime, such as form shells and fish-bones, the sulphur, phosphorus, and nitrogen in the flesh and nerves of these animals, and other elements of concentrated fish guano.

EXPERIMENTS WITH FIELD SEEDS.

All seeds sent forth by the Department for test and experiment are accompanied with a request to report results in all essential details. A digest of the more important of these reports will be presented among the annual transactions of the Department. The following statements are the results of experiments made in different parts of the country with seeds which were distributed with the view of ascertaining their adaptation to the different soils and climates of the United States:

WINTER WHEAT.

Windsor County, Vermont.—One quart of Tappahannock wheat was sowed on an alluvial soil the 1st of October; yield, ten quarts of fine wheat with very full kernel; quality superior to any other wheat in that section.

Bristol County, Massachusetts.—The Tappahannock wheat has been successful in some parts of the State; in Bristol County twelve to sixteen bushels per acre having been raised.

Hampden County, Massachusetts.—One quart of each variety of the White and the Red Mediterranean wheat was sowed the 4th of October, and harvested the 16th of July. The yield was fifty-one pounds of the Red and forty-six of the White. The Red yielded better than the White, and appears more desirable for the Connecticut Valley. It was grown on sandy soil, and is superior to the native varieties.

Newport County, Rhode Island.—The White Flint, the Tappahannock, and the White Mediterranean wheat have been cultivated, but with little success. The largest yield is only about sixteen bushels per acre, on a soil which would produce fifty or sixty bushels of corn.

Dutchess County, New York.—The Tappahannock wheat sown last fall was a failure. No kernel was formed in the heads.

Jefferson County, New York.—A quart of Sandomirka wheat was sown in drills, the last of August, on five and a half square rods of ground, which had not been manured, and had produced three crops after being cleared up from the forest. The crop was harvested the last of July, and produced forty-seven and a half pounds of fine, plump wheat, at the rate of twenty-three bushels per acre. It seems well adapted to the soil and climate of New York, and preferable to the common spring wheat.

Tioga County, New York.—Tappahannock wheat, received from the Department, is quite fifteen days earlier than any other variety.

Cayuga County, New York.—Tappahannock wheat, sown on the 10th of September; grew well; stood the winter first-rate; ripened about the 8th of July, with large heads and plump kernel; and escaped by its earliness both rust and weevil, which injured other varieties badly.

East Maine, New York.—The White Mediterranean and Sandomirka wheats were badly winter-killed, and produced less than an average crop. The Polish wheat yielded a good crop—superior to anything in the vicinity.

Wyoming County, Pennsylvania.—The Tappahannock wheat is ten days earlier than any other variety grown in this county. Two quarts of seed,

received from the Department, yielded from the second year's sowing five bushels of very fine wheat.

Lancaster County, Pennsylvania.—One quart of the Tappahannock wheat, sown on the 18th of September, yielded seventy-nine pounds. It ripened twenty days earlier than other varieties, and was not injured by the midge. It stood the winter well, and promises to be the wheat for this region.

Columbia County, Pennsylvania.—One quart of Tappahannock wheat, sown broadcast in September, on one-twentieth of an acre, ripened a week earlier than other varieties, and produced eighty-two pounds, or over twenty-seven bushels to the acre, of screened wheat of fine quality. Our reporter says, if it does not deteriorate, it will be a great acquisition.

Montgomery County, Maryland.—The Tappahannock and the White Mediterranean wheat are cultivated in the county. The White Mediterranean yields more, but the Tappahannock commands a higher price.

Baltimore County, Maryland.—The Tappahannock wheat ripened early, and yielded exceedingly well. There was no appearance of injury from the midge.

Amelia County, Virginia.—After a trial of twenty varieties of wheat, preference is given to the Tappahannock, which is now found on almost every plantation. If sown from the 20th of September to the 10th of October, it will ripen from the 10th to the 25th of June.

Powhatan Hill, Virginia.—The Tappahannock wheat has failed generally, and is likely to be abandoned, as most popular varieties have been after having a good run for a few seasons.

Montgomery County, Virginia.—About a pint and a half of the Tappahannock wheat produced three pecks of the most perfect wheat our correspondent ever saw. The kernel was one-fourth larger than the sample sown.

Dover Mines, Virginia.—Seven quarts of Mediterranean wheat, drilled one foot apart, produced seven bushels of heavy wheat, uninjured by rust.

Clarke County, Virginia.—The Tappahannock wheat was somewhat injured by the fly. The injury appears to have been occasioned by late sowing. Fields sown in September produced heavy crops of fine quality Tappahannock wheat is preferred to any other in Greene, Washington,. Wythe, Craig, Louisa, and Clarke counties.

Duplin County, North Carolina.—About a quart of Tappahannock wheat was sown on a stiff, sandy loam, in drills eighteen inches apart. The land was as fertile it could well be made. After the grain came up about one-fourth was destroyed by grasshoppers. In February a top-dressing of guano and phosphate of lime was applied, mixed, at the rate of two hundred pounds to an acre. In April the rabbits destroyed nearly one-fourth of what remained. A crop of three and a quarter bushels was harvested from the one quart of seed. It grew five feet high, and ripened ten days earlier than other winter wheat.

Albermarle County, North Carolina.—Two quarts were sown on high, dry land, a gravelly clay slate, without manure, and produced, from a little more than half an acre, seven bushels of fine wheat. It tillered astonishingly, as many as fifty heads sometimes growing from one kernel. They were much larger than common, and the wheat weighed sixty-two and a half pounds per bushel. No other variety yielded anything like the Tappahannock.

Franklin County, North Carolina.—Two and a half pounds of Tappahannock wheat, sown on four hundred square yards of ground, poorly prepared, ripened eight or ten days earlier than other wheat in the

vicinity, and yielded eighty pounds, or at the rate of about seventeen bushels per acre—sixty-two and a half pounds to a bushel. The grain was injured by the rains.

Chester, North Carolina.—The Tappahannock wheat is much esteemed by the few who have tried it; it is ten days later than the Alabama.

Earlesville, South Carolina.—The Tappahannock wheat will succeed better in this latitude than the Russian, and will prove a valuable acquisition.

Carroll County, Georgia.—The Tappahannock wheat sent by the Department yielded one hundred to one.

Belair, Georgia.—One quart of the Red-bearded Mediterranean wheat, sown on six and a half square rods, produced two bushels, weighing sixty-four pounds to the bushel.

De Kalb County, Alabama.—Two pounds of Tappahannock wheat were sown on a piece twenty feet square, the land being much worn, soil about three inches of dark loam, and stiff clay subsoil, cultivated with corn the previous year, and fertilized with four loads of stable manure, plowed under. The yield was two and a half bushels of the finest wheat ever seen in this section.

Claiborne, Mississippi.—The Tappahannock and Mediterranean wheats made a large yield. The former was a little injured by the rust, but the latter was untouched.

Washington County, Mississippi.—White Mediterranean and the Tappahannock wheat, sown the 11th of November, were ripe the first of June, and yielded thirty-five bushels per acre.

Union Parish, Louisiana.—The Tappahannock wheat has been introduced into Union Parish, and has shown that wheat may be successfully grown in that part of the State. In most parishes the culture is considered impracticable, on account of rust. The season of sowing is the last of October and the first of November; of harvesting, the latter part of June.

Giles County, Tennessee.—The Tappahannock wheat, sown the 10th of October, ripened two weeks earlier than other varieties, and yielded one-fourth more of excellent wheat. Our correspondent thinks it will prove to be of great advantage to that section.

Smith County, Tennessee.—Two pounds of Tappahannock wheat, sowed on one twenty-fourth part of an acre, produced eighty pounds of very fine wheat. More than ten pounds of it were destroyed by Guinea chickens just before ripening. After this loss it yielded at the rate of over thirty-five and a half bushels per acre, more than twice the yield of the wheat commonly cultivated.

Hawkins County, Tennessee.—Four quarts of Tappahannock wheat yielded one hundred and sixty-four quarts. The correspondent states that it was as fine wheat as he ever saw in this country or in England.

Davidson County, Tennessee.—The Tappahannock wheat has had a fair trial in this section. Last season one hundred and twenty acres were sown, and yielded thirty bushels per acre. From four quarts of Tappahannock wheat, received in 1866, enough was raised in 1867 to produce sixty-three bushels in 1868. Our correspondent says that its vigorous growth, hardiness, early maturing, freedom from rust and smut, and its abundant yield and fine flour, recommend it to all cultivators.

Coffee County, Tennessee.—Our correspondent is satisfied that the Tappahannock wheat will prove a success in this section. It stood well through the hard winter of last season, and made a large yield of beautiful wheat. The White Mediterranean and the White California grew beautifully, but did not stand the winter so well.

The Tappahannock wheat has become popular in Greene, Hawkins, Union, Rhea, Monroe, Polk, and other counties, on account of its earliness, freedom from rust, certainty, and productiveness.

Braxton County, West Virginia.—Trials of the Tappahannock wheat, for the past two years, justify the conclusion that it is ten days earlier than any other kind, and that the grain is of better quality. It is free from rust and the weevil. The Tappahannock is also preferred in Marion County and Kanawha.

Benton, West Virginia.—A peck of Tappahannock wheat sown last fall was sufficiently ripe to harvest the first of July; thought to be the best wheat in the neighborhood.

Kentucky.—The White May and the Tappahannock wheat are preferred, the former for its early maturity and exemption from rust; the latter for its good yield, and for the preference given to it in market, being fifteen to twenty cents higher per bushel than other varieties.

Missouri.—The Tappahannock wheat is popular so far as it has been introduced, being earlier, and yielding better flour than most other varieties. It is sown in September and October, and harvested from the middle of June to the middle of July.

Sedalia, Missouri.—One pint of Tappahannock wheat, sown two years ago, has produced five bushels, and the variety has done well thus far.

Hannibal, Missouri.—The Tappahannock wheat has been cultivated for two years. It gives an average yield of thirty-five bushels per acre; ripens about the same time as the Early May, but is a better wheat. It will be a valuable acquisition.

Hermitage, Missouri.—The Tappahannock wheat ripens about two weeks earlier than other varieties, and, for this reason, has always escaped the rust; does not yield quite so much as other wheat, but its full kernel and superior flour fully compensate for this deficiency.

Harrison County, Missouri.—One quart of the Mediterranean wheat produced forty pounds of good grain, though injured considerably by grasshoppers.

Baxter's Springs, Kansas.—The Tappahannock wheat, received from the Department, is superior to any other kind cultivated here.

Canton, Illinois.—One pound and a half of the Tappahannock wheat produced twenty pounds, fully equal in quality to that received from the Department.

Hardin County, Ohio.— One quart of Tappahannock wheat produced twenty quarts of handsome, plump grain, equal, if not superior, to the seed sent.

Portage County, Ohio.—The Tappahannock wheat is preferred in this county. It is sown from the 1st to the 20th of September; harvested from the 1st to the 12th of July.

Michigan.—The Tappahannock wheat holds a high rank for its early ripening, large yield, and fine quality of flour. White's Bald Mediterranean is becoming a great favorite.

Berrien County, Michigan.—The Tappahannock, the Tasmania, and the Chiddam wheat were sowed in equal quantities, side by side. The Chiddam was entirely destroyed, while the others were not injured. The Tappahannock and Tasmania made a fair yield, but our correspondent thinks the White Mediterranean ahead of the other varieties.

Washtenaw County, Michigan.—The Tappahannock wheat, sown about the 1st of October, ripened nearly three weeks earlier than the Treadwell, sown at the same time and on the same soil. Seventy-four pounds of good, heavy wheat were raised from one quart sown, weighing over sixty pounds per bushel.

Lenawee County, Michigan.—One bushel of very plump white wheat was raised from one quart of the Tappahannock variety, sown the 29th of September.

Schoolcraft, Michigan.—Sowed five-eighths of an acre with the Tappahannock wheat; raised at the rate of thirty-two bushels per acre. The best wheat of other varieties did not yield more than twenty-five bushels.

Lexington, Michigan.—The Tappahannock wheat, sent by the Department, proved a complete failure. The climate seems too severe for its growth: it was badly winter-killed, notwithstanding the precautions taken.

Lapeer County, Michigan.—One bushel of the Tappahannock wheat, sown the 20th of September, produced twenty-four bushels of as fine wheat as our correspondent ever saw; it weighed on an average sixty-five and a half pounds per bushel. It is not perfect proof against the midge.

Ingham County, Michigan.—Two quarts of Tappahannock wheat were sown on different farms. One lot was winter-killed on account of the wet condition of the soil: the other grew finely, and produced twenty-eight pounds of beautiful wheat.

Wisconsin.—The Tappahannock wheat has been received with much favor, but the Mediterranean, the Blue Stem, the White Wabash, and the Winter Club are preferred.

Monroe County, Wisconsin.—One quart of Tappahannock wheat, sown the 15th of September and harvested the 4th of July, yielded at the rate of thirty-two bushels per acre. It was not infested by insects as other varieties were, and matured twenty days earlier. It is the most popular grain in that part of the State, where the thermometer sinks to twenty-eight degrees below zero.

Des Moines County, Iowa.—A quart of the Tappahannock wheat, received from the Department of Agriculture, produced a hundred bushels at the third sowing. It brought $4 per bushel, when sold for seed.

Another report from Iowa says: Forty acres, sown with Tappahannock wheat, produced one thousand bushels of fine grain. Average twenty-five bushels per acre.

Cuming County, Nebraska.—Two-thirds of a quart of White Mediterranean winter wheat were sown in the hope of making it spring wheat. It grew finely, and produced three pecks of excellent wheat.

Washington, Utah.—The Tappahannock wheat, sent by the Department, was harvested in May: it was full and plump, and will succeed well here.

Aurora, Nevada.—The Tappahannock wheat is of good quality: ripens early, which is an important consideration where the seasons are so short.

SPRING WHEAT.

New London County, Connecticut.—On the 13th of April, one quart of Arnautka spring wheat was sown in drills on sandy loam, fertilized with horse manure, hen manure, and ashes, scattered along the drills. The other package was sowed in a compact soil, in better condition, and manured highly in the drills. Both did well, but that on the sandy soil did best. The yield was at the rate of twenty bushels per acre, of very nice grain. It proves to be a very valuable variety for that locality.

Baltimore County, Maryland.—The Arnautka spring wheat was injured

by the midge, about one-fourth being destroyed. The injury was probably caused by late sowing. The wheat had a very beautiful appearance.

Washington, D. C.—Among the large number of varieties of spring wheat tested on the experimental farm, the Black Sea wheat, from California, proved to be the earliest and best. It was sown the 12th of March, and came into ear the 28th of May, in eighty-one days. The red Chili was sown at the same time, and was only about three days later in coming into ear. This is a very promising variety.

Timber, Illinois.—One quart of Arnautka spring wheat yielded sixteen quarts of good quality, making more and better flour than any other wheat.

Clinton County, Indiana.—Two quarts of Arnautka wheat were sown broadcast on common clay land, the 16th of April, at the rate of one and a half bushel per acre. It was harvested the 20th of July, and produced at the rate of twenty bushels per acre. It was not attacked by the weevil or rust, and is regarded by wheat growers as a success. There was only about one-fourth of a crop of native wheat.

Washington County, Minnesota.—The Scotch Fife wheat is preferred here, being less liable to rust than other varieties, and standing up better. The Black Sea is very popular. Little winter wheat is cultivated.

Le Sueur County, Minnesota.—One pound and three-fourths of Arnautka spring wheat was sown April 24. It grew finely and stood up well. When harvested, August 12, the yield was fifty pounds. Our correspondent says it appears to be a good kind of wheat, and well adapted to that soil (a sandy loam) and climate.

Dubuque County, Iowa.—One pound and a half of the Arnautka spring wheat was sown in drills, on three square rods of ground. Sixty-one pounds were harvested, being about fifty-three bushels per acre.

Johnson County, Nebraska.—One pint of Arnautka wheat, sown the 20th of April, produced twenty-five pounds of good wheat. It appears to be well adapted to Nebraska.

Aurora, Nevada.—Three table spoonfuls of the Arnautka wheat, sown in the spring for two seasons, has increased to six and a quarter bushels of large and plump grain.

OATS.

East Maine, New York.—Two and a half bushels of the Swedish oats produced thirty-one bushels, weighing thirty-nine pounds to the bushel, although damaged at least twenty-five per cent. by drought. The Strausburg yielded well, but not so well as the Swedish.

Ashtabula County, Ohio.—The Poland oats, sent from the Department of Agriculture, yielded about fifty-fold, while the common variety produced only about twelve-fold.

Calhoun County, Michigan.—From a quart of the Potato oats, sent from the Department, two hundred bushels of fine, sound oats, weighing about forty-five pounds per bushel, were raised from the second sowing. Our reporter considers one bushel worth two of the common oats, which weigh from twenty-eight to thirty-two pounds per bushel.

Sibley County, Minnesota.—The New Brunswick oats, sent from the Department of Agriculture, yielded forty-five bushels per acre, and averaged forty-seven pounds per bushel.

Cuming County, Nebraska.—A little less than a quart of white Swedish oats produced more than a bushel, weighing forty pounds per bushel.

Iron County, Utah.—From eight ounces of white Swedish oats, a crop of seventy-six pounds was raised, being at the rate of one hundred and fifty-two bushels from one. The soil was a sandy loam, liberally dressed with barn-yard manure, plowed in.

Aurora, Nevada.—Three table spoonfuls of Swedish oats yielded one bushel of fine, plump grain.

CLOVER.

Hennepin County, Minnesota.—The Alsike clover proved true to its name, and bore last year a heavy crop: smothered out the timothy: will prove a valuable acquisition for Minnesota. The black and the Italian bees worked upon it from June to October.

Jefferson County, Missouri.—Sowed the Alsike clover received from the Department; growth very luxuriant; the best clover ever cultivated on the farm.

Montgomery, Texas.—After thirty years' experience with the most celebrated grasses, such as fescue, &c., none approaches in value the California clover. It grows well on any soil, affording two crops of hay annually, double the yield of any other grass. Once sowed, it grows perpetually. Cows afford more and better milk and butter when grazed on this, than on any other grass. It is thought that it would be a valuable addition to the grasses of the middle and southern States.

RECENT FARM EXPERIMENTS.

The following statements, condensed from a mass of material gathered from various sources, are not presented with a view to deciding contested agricultural theories, but rather as a compilation of the results of experiments, which shall be considered as suggestive rather than authoritative; suggestive, particularly, to the many who have not the disposition, or the time, for scientific discussion, but who may be interested in the accounts given by plain working farmers of the methods which they have tested.

It is hoped that the examples here given may induce others to experimental effort, with increased knowledge as to what is needful to render such effort valuable to themselves and to the public—there being great necessity for more care in conducting farm experiments and for greater precision in the statement of results. In making these selections, many similar statements, apparently valuable at first glance, have been rejected on account of the omission of important facts. Failure to state the character of the soil on which the trial was made; the quantity of seed sown; the nature, amount, and cost of manures applied; the product from a given area—omission, or at best, want of precision in the statement of one or more of these and similar points, is so frequent as to be rather the rule than the exception. The constant occurrence of such inaccuracies is indeed not surprising: but not the less is it to be regretted, and not the less should effort be made for its avoidance.

Frequent, careful, and practical field trials are especially desirable in the present agricultural condition of this country. There is a class of European agricultural experiments, very valuable and made at large cost of time and money, which are so distinctively *scientific* as to serve our agriculturists often rather as oracular authorities, whose decrees must be translated for the uses of actual process, than as direct guides to economical methods of farm culture. Says Professor Voelcker of the Royal Agricultural Society of England—one of the most thorough scientific experimentalists of the age: "The scientific experimenter is not necessarily interested in the economical result of a field trial; direct profit is not his aim, but rather the establishment of general principles which may be applied by the practical farmer." He adds: "It is for the farmer to keep these general principles in view, and to determine for himself what practical bearing such principles have on the cultivation of his crops in a particular locality."

WHEAT.

The following statements are condensed from the reports of the several competitors for the premiums offered by the Athens (Georgia) Wheat Club, the report in each case having been made upon one acre of wheat entered.

No. 1. *Report of Dr. J. S. Hamilton.*—Land, light gray or sandy surface soil, with red clay subsoil; brought into cultivation in 1867, and planted in corn and peas, producing about 12 bushels of corn. November 7, the lot was plowed and replowed at right angles, close and deep, with a scooter plow; 70 bushels of cotton seed were then spread and

turned in with a two-horse plow, breaking the soil to the depth of six or eight inches. November 12, a mixture of 385 pounds each of Peruvian guano and dissolved bone (the latter of Georgia manufacture, two parts bone to one of acid, with equal weight of ground pine charcoal) was spread very evenly. November 13, 137 pounds of Tappahannock wheat, steeped in a solution of salt and bluestone, was sown and plowed in with the fertilizer, and then harrowed and rolled. A top-dressing of two sacks of ammonia phosphate was applied about the 1st of March. Cost of 70 bushels cotton seed, \$14; guano and dissolved bone, \$49 08; ammonia phosphate, \$7 28; total, \$70 36. Yield, 45 bushels 30 pounds.

No. 2. *Report of J. W. Nicholson.*—Land very poor; cultivated but once in six years, when it was sown in oats. The field was plowed three times with a scooter plow, and wheat harrowed in—a red-bearded variety, slow in maturing and not prolific, but said to escape rust. Seed sown October 15; quantity, two bushels. Manure applied—seven two-horse loads stable manure, 20 loads of half-rotted chips and leaves, three loads of well-leached ashes, 1,000 pounds of Phenix guano, and eight loads of clay; the whole valued at \$63 50. Top-dressed, March 10, with 250 pounds of Peruvian guano. Wheat cut June 4. Yield, 21 bushels 30 pounds. The drought killed more than one-half as it sprouted, and storms blew the plants down when in bloom and heading out, and one-third were flat on the ground when cut. Little damage from rust, but rabbits and dogs injured the crop one-fourth.

No. 3. *Report of R. L. Bloomfield.*—The acre was poor upland, uncultivated for fifteen or twenty years. Land was broken up with a two-horse plow followed by a scooter in each furrow, and then thrown up in beds sixteen feet wide, leaving water-furrows between the beds. The beds were then furrowed with a turning shovel, and cotton seed sown and covered with the next furrow, the latter process being continued until 70 bushels of the cotton seed had been applied. Cost of 320 pounds of guano used, \$16; 70 bushels of cotton seed, \$14; 15 loads of stable manure compost, \$20; total, \$50. Wheat sown the second week in December, a bearded variety, one and a quarter bushel. A top-dressing of five loads of compost was applied in the spring with great advantage. Crop cut June 17. Yield, 32 bushels 46½ pounds. The season was wet until the wheat bloomed; afterwards dry until the crop ripened.

No. 4. *Report of Captain H. A. Gartrell.*—The field was red valley land, in constant cultivation for many years, and in wheat the previous two years. When the crop was cut the stubble was turned under with a bushel of peas; and, October 1, the green pea-vines were plowed under. Three weeks afterwards the ground was broken with a subsoil plow, fourteen inches both ways, and 400 pounds Baugh's phosphate, 200 pounds Peruvian guano, and 200 pounds gypsum applied. October 22, two bushels of inferior wheat were sown and plowed in, harrowed and rolled. No top-dressing used. Harvested May 26. Yield, 21 bushels 26 pounds. Season unfavorable; frequent rains with high winds, followed by hot sunshine. Wheat blown down in spots two or three times. Crop cut short one-half by rust.

No. 5. *Report of A. P. Dearing.*—Soil thin and gravelly, on a ridge sloping to north and west; one-fourth partially fertilized as the resting place of cattle; ten years in cultivation, the last three seeded to wheat. The lot was plowed with a turning plow, followed by a scooter in the same furrow, after which 100 bushels cotton seed, 500 pounds Peruvian guano, and 600 pounds dissolved bone were applied and plowed in. November 2, three bushels of Tappahannock wheat were sown and harrowed

in; and in February a top-dressing of 100 pounds salt and 20 bushels ashes was applied to three-fourths of the acre, and in April about 100 pounds of salt, 100 pounds Augusta fertilizer, and 100 pounds Peruvian guano, to the same area. Yield, 40 bushels 23 pounds. When in bloom, one-fourth of the acre was prostrated by frequent storms. Rust on the blade from the time it commenced to fill; stalk, before cutting, entirely bare. When cut, in June, one-fourth was badly tangled, and flat on the ground. The portion treated with ashes and salt did not fall.

No. 6. *Report of General W. M. Browne.*—Soil poor, gray surface, and red clay foundation; an old second-growth pine field, cleared in 1866 and seeded to wheat in 1866–'67. After the harvest of 1867 the land was plowed thoroughly across the old furrows, and peas sown and plowed in. The last of September, the peas were sprinkled with lime and turned under with a two-horse plow. In a few days thereafter 100 bushels of cotton seed were turned under with a Brinley plow, followed in the same furrow by a scooter, breaking the soil six or seven inches. Fertilizers used: 100 bushels cotton seed, 250 pounds Peruvian guano, and 250 pounds Reid's superphosphate, costing $43 75. No top-dressing applied. Wheat sown November 1, after soaking in brine and a solution of bluestone. Harvested May 1. Yield, 38 bushels 52½ pounds. Much rain and high wind in April and May, and considerable rust on the blade.

No. 7. *Report of Colonel D. C. Barrow.*—Gray land, thin and poor, utterly exhausted by repeated croppings. A very poor crop of wheat taken from it last year. In the summer two bushels of peas were sown, and in September turned under with a two-horse plow. The first week in November, 100 bushels cotton seed were spread and plowed under, the soil being pretty well pulverized, but not thoroughly. Two bushels of Tappahannock wheat, 1,150 pounds Reid's phosphate, and 250 pounds Peruvian guano were sown and plowed in together, and the field then dragged smooth with brush. Two gallons of clover were also sown. Cost of 100 bushels cotton seed, $20; 1,150 pounds phosphate, $28 75; 250 pounds guano, $12 50; total, $61 25. Harvested June 3. Yield, 27 bushels. In the gullies and clayey places the stand was injured by winter-killing; and there was some loss from rust on the blade.

No. 8. *Report of Colonel B. C. Yancey.*—Soil poor; in cultivation many years; produced last season, without manure, seven bushels of wheat. Land broken in October with a two-horse Brinley plow, followed by a sub-soiler; cross-broken with a two-horse plow, and then harrowed and rolled before sowing. About 60 bushels of cotton seed, two barrels bone flour, 750 pounds Peruvian guano, and one barrel land plaster were used as fertilizers. December 3, three bushels of Schley wheat were sown; top-dressed in the spring with two bushels of salt and eight bushels of ashes. Value of fertilizers, $75. Harvested June 16. Yield, 39 bushels 16 pounds. Winter rather wet and peculiarly unfavorable to the locality, which was level upland, receiving surplus water from adjoining slopes of rising land. In addition to leaf mold, the crop was damaged by rust on the stem from June 3 to June 16. While sprouting a severe freeze injured the stand. The opinion is expressed by some Virginia farmers that the use of plaster produced the rust, the season having been wet. Colonel Yancey thinks an excess of guano and bone-dust was used.

No. 9. *Report of Major A. L. Dearing.*—Gray land, with red clay foundation; inclined to be sandy; in cultivation five years. The field was plowed with a turning plow, followed in the same furrow with a long bull-tongue plow; crossed in the same manner, and harrowed twice.

November 11, two and a quarter bushels Tappahannock wheat were sown; and March 12, 75 pounds Peruvian guano, 12 bushels ashes, and one bushel salt, were applied. Total of fertilizers used, 331 pounds Peruvian guano, 280 pounds dissolved bone, and 68 one-horse loads barnyard manure, the whole valued at \$70. Yield, 35 bushels 6 pounds. The wheat rusted badly on the blade and slightly on the stalk, and about thirty feet square fell down.

Remarks.—In all these cases the wheat was sown broadcast, drilling not yet having received, in the South, the favor which it merits. Nos. 2 and 7 indicate a less thorough pulverization of the soil than do the other statements. The unfavorable circumstances mentioned at the close of these two reports as affecting the crops appear to be paralleled in several cases in which a much larger yield is exhibited. In No. 5, the falling of the wheat on the one-fourth acre fertilized only by cattle droppings may in a great measure be accounted for by the non-application of salt and ashes on that portion of the field, two materials tending specially to strengthen and harden the stalk and to aid in resisting rust.

Recapitulation in order of yield.—No. 1. Thin, sandy surface soil, with red clay subsoil. Plowed thoroughly, stirring the subsoil; strongly and very evenly manured, and top-dressed. Seed of an excellent variety, well adapted to the climate, in quantity about two and a quarter bushels. Yield, 45 bushels 30 pounds. Cost of manures, \$70 36.—No. 5. Soil thin and gravelly; well prepared with the plow, and heavily fertilized. Too much seed sown, crowding and thereby damaging the growth in quality and in power of resisting disease, and consequently in amount of yield; quantity of seed, three bushels. Yield, 40 bushels 23 pounds.—No. 8. Soil poor, and worn by long cultivation; by peculiar formation of the surface accumulating superabundant moisture; well prepared by plowing and manuring. Too much seed sown; quantity, three bushels. Yield, 39 bushels 16 pounds.—No. 6. Land old and poor, surface soil and subsoil similar to No. 1; well prepared by plowing; well manured, but not top-dressed. Yield, 38 bushels 52½ pounds. Cost of manures, \$43 75.—No. 9. Soil and subsoil similar to Nos. 1 and 6; well plowed and heavily fertilized. Yield, 35 bushels 6 pounds.—No. 3. Soil poor upland, cultivated fifteen to twenty years; well prepared by plowing and manures. Yield, 32 bushels 46½ pounds. Cost of manures, \$50.—No. 7. Thin and very poor gray soil; not thoroughly pulverized; well manured, but not top-dressed. Yield, 27 bushels.—No. 2. Soil not well pulverized. Yield, 21 bushels 30 pounds.—No. 4. Soil apparently well prepared. "Very poor seed." Yield 21 bushels 26 pounds.

The average yield of these nine acres was 33 bushels $32\frac{2}{9}$ pounds per acre, the value of which, at \$2 35 per bushel, (the average rate of wheat in Georgia in 1867,) would amount to \$78 81. Make the small addition of \$3 19 as the value of the straw, and the total amount is \$82. Estimate labor, seed, &c., at an average cost of \$17 per acre; the average cost of manures at \$60; thus making the average cost of production \$77 per acre. This leaves an average *immediate* pecuniary profit of \$5 per acre. The immediate profit of No. 1 may be estimated as at least between \$25 and \$30 per acre. Oppose to this the common plan of "as little cultivation as possible," allowing to it a production of wheat per acre equal to the average in Georgia in 1867, viz., eight bushels. (In 1866 the average was four bushels.) At this rate, the value of the product, straw included, would be \$19 60. Furthermore, to give this side of the question every advantage that it can plausibly assume, state the cost of seed and culture at \$14 60 per acre, which will leave an *immediate* profit of \$5 per acre.

Now observe the contrast between the high culture and the low, even when exhibiting at the outset apparently the same immediate pecuniary profit. On the one hand, the soil brought forward from an impoverished to a highly productive condition; on the other, the already impoverished land made poorer by every cropping until reduced to barrenness. Nor is this a full statement of the bearings of the case. The above experimental trials were made for premiums and for an especial purpose, at enormous outlays for fertilizers. They are not presented as examples of what should be the usual course of farm administration in the restoration of the land to a state of generous and profitable culture. In such a course the process of renovation would be more gradual, and without extravagant outlays; and the returns would be more surely satisfactory.

These experiments are evidences that a better day is dawning on southern agriculture, and that, in spite of all temporary discouragements, intelligence and enterprise are surely, if slowly, making their mark on its general character.

CULTIVATION OF WHEAT.

Public attention has been directed, in the recent reports of this Department, to the propriety of making experiments in the cultivation of wheat in wide drilling and thin seeding. The fact that millions of acres of wheat are annually overrun with weeds, and that sod lands, imperfectly pulverized, often yield larger crops than the same soil in a better mechanical condition but thoroughly seeded with wild plants of rampant growth, ought to suggest the probable success of a system of cultivation of growing wheat whereby it might have unchecked opportunity for growth, tillering, and perfect ripening, with such robustness of stalk as to preclude the liability of falling, and consequent imperfection and loss of grain.

Several correspondents of the Department acted upon these suggestions, and reported favorable results. One, in Rock County, Wisconsin, cultivated ten acres, planted in drills fourteen inches apart, with two pecks of seed per acre, with success so marked as to induce him to put in seventeen acres more.

Mr. R. A. Gilpin, of West Chester, Pa., in 1866 planted one acre with three pecks of seed in drills twenty inches apart, and drilled the remainder of the field at intervals of ten inches. In the spring, when the ground had become sufficiently dry, a small garden hoe-harrow was run between the wide rows, working three inches deep. "The wheat took a rapid start and outgrew the rest of the field. As the season advanced it grew tall and strong, and no amount of wind or rain had any effect to lay it down. When the heads formed, their greater length was apparent. It was backward in ripening, and the rest of the field was cut and hauled in before this was ripe." But the single acre yielded twenty-three bushels, while the remainder of the field produced only nine bushels per acre. Thus a *single hoeing* produced fourteen bushels on an acre, or 155 per cent. increase, worth at the current value $30, besides saving one-half of the value of the seed. A large number of results like these, definite and particular, in varied circumstances of soil, climate, and condition, would test the pecuniary advantage of horse-hoeing wheat.

METHODS OF SEEDING COMPARED.

The following is a report of an experiment made by a member of the Goodhue Farmer's Club, Minnesota, with three fields seeded to spring

wheat of the China Tea variety. The statement exhibits, among other points, the great advantage arising from a proper method of drilling, in giving equal growth to the wheat plants and sufficient room for their development.

Field No. 1, two bushels of seed per acre, sown with broadcast sower and cultivator combined, the seed being planted at depths varying from one to four inches. Field No. 2, five pecks per acre, sown in drills, east and west, two and a half inches deep. Field No. 3, three pecks per acre, sown in drills, east and west, two and a half inches deep, eighteen inches apart; cultivated but once, when about a foot high, with a five-toothed walking cultivator, at an expense of one dollar per acre.

Results.—No. 1, good wheat, head medium in length, well filled, and standing thick on the ground; unequal in growth, some straws being five and six feet long, others only two feet; some heads very green, others ripe; estimated yield twenty to twenty-five bushels per acre. No. 2 had a better color during growth than No. 1, and was very even in straw and degree of ripeness; heads about even, of extra length; bundles very heavy; estimated yield, thirty bushels per acre. No. 3 was extra at all times, its unusual deep-green color and broad leaves attracting much attention: no one supposed it the same kind of grain as lots 1 and 2; it stooled out much more than either, and was uniform in ripeness and length of straw; estimated yield, thirty-five to forty bushels per acre.

The Club concluded that they had been in the habit of using too much seed for spring wheat, and that wheat needs cultivation.

THE PROPER TIME TO HARVEST.

Several experiments touching the proper time for harvesting wheat are detailed in agricultural papers published in different sections of the country, the results of which are corroborative of the theory, already well established, that wheat should be cut when the grain is in the *dough* state. The yield of flour is then greatest in quantity and best in quality, and the straw also is in the best condition. The principle and its exemplification in practice will be found fully set forth in the reports of this Department for 1850, (p. 102,) and 1856, (p. 246.) Wheat grown for seed should, of course, stand till ripe.

WHEAT AFTER CLOVER.

With regard to the peculiar influence of the red clover crop on the subsequent growth of wheat, Professor Voelcker, reporting on experimental trials, in the Journal of the Royal Agricultural Society of England for 1868, says: "The heaviest crops of clover *removed* from the soil appear to render it more capable of yielding a good crop of wheat. The addition of even powerful saline manures (superphosphate of lime, mixed alkalies, &c.) seems hardly to improve the subsequent wheat crop. * * * * * It is a fact that after a heavy crop of clover carried off as hay, the land, far from being less fertile than before, is peculiarly well adapted, even without the addition of manure, to bear a good crop of wheat the following year, provided the season be favorable to its growth. * * * * Clover mown twice leaves the land in a better condition, as regarding its wheat-producing capabilities, than when mown once only for hay, and the second crop fed off the land by sheep."

Further remarks are, in substance, that land whereon [A] clover has been grown for seed the preceding year appears to yield a still better

crop of wheat than when [B] the clover is mown twice for hay, or when [C] mown once and afterwards fed off by sheep. Among the stated results of the professor's investigations are the following: 1st. During the growth of clover a large amount of nitrogenous matter accumulates in the soil. 2d. This accumulation, which is greatest in the surface soil, is due to decaying leaves dropped during the growth of clover, and to an abundance of roots containing, when dry, from one and three-quarters to two per cent. of nitrogen. 3d. The clover roots are stronger and more numerous, and more leaves fall to the ground, in case A than in case B. 4th. In case C the development of clover roots is checked, and the consequent loss of fertilization is not sufficiently counterbalanced by the excrements of the sheep on the land. The subjoined table represents certain comparative effects of cases A and B.

	A. Clover soil once mown and then left for seed.			B. Clover soil twice mown.		
	First six inches.	Second six inches.	Third six inches.	First six inches.	Second six inches.	Third six inches.
Percentage of nitrogen in dried soil	.130	.134	.089	.168	.092	.064
Equal to ammonia	.229	.162	.108	.198	.112	.078

Another deduction is thus given: "Clover not only provides abundance of nitrogenous food, but delivers this food in a readily available form (as nitrates) more gradually and continuously, and, consequently, with more certainty of a good result than such food can be applied to the land in the shape of nitrogenous spring top-dressings."

THE ROTHAMPSTED EXPERIMENTS.

The following is a brief summary of experiments of J. B. Lawes, Rothampsted, Herts, England, on different plots of wheat for the last six years; being in continuation of like experiments on the same areas made annually since 1852. During the whole seventeen years "the same description and amount of manure have been applied on the same plot each year. In every other respect the treatment has been the same over all the plots each year, and as nearly as possible the same year after year. The variation in the product from year to year may, therefore, be considered as almost entirely due to the varying character of the seasons." Plots numbered 3, 2, and 9, are nearly one-third of an acre each, and plots numbered 7 and 8 are each nearly two-thirds of an acre. The results are given as follows:

Plots.	How manured each year.	Harvests. Bushels of dressed wheat per acre.						Average of 16 years, 1852–'67.
		1863.	1864.	1865.	1866.	1867.	1868.	
3	Unmanured	17¼	16½	13¾	12⅝	[illegible]	[illegible]	[illegible]
2	Farm-yard manure	44	40	37¼	32⅝	27¼	41¼	35⅛
7	Artificial manure	53⅝	45¾	40¼	30	[illegible]	[illegible]	[illegible]
8	Artificial manure	55¼	49⅜	46⅛	32½	30½	[illegible]	[illegible]
9	Artificial manure	55½	51	44	32½	29¼	47¾	35¾
	Average of 7, 8, and 9	55	49	42⅝	31½	27¼	44¼	35⅝

Plots.	How manured each year.	Harvests. Average weight per bushel. (lbs.)						Average of 16 years, 1852–'67
		1863.	1864.	1865.	1866.	1867.	1868.	
3	Unmanured	62.7	62.0	60.6	61.3	58.1	61.0	57.4
—	Manured	62.5	62.9	61.4	60.9	60.8	61.5	59.0

Here is an increase of fully two and a half per cent. in weight per bushel, as the result of manuring.

The experience thus set forth will caution the farmer not to make the production of a single season the criterion for a given method of culture. In forming his judgment, he should consider whether the season fairly represents the average of several years. And, in determining this point, the state of surrounding crops will generally afford much assistance.

It should be observed that the above-mentioned areas were all under a high degree of mechanical culture. The years 1867 and 1868 were exceptional throughout England, as regarding the wheat crop; the former year exhibiting a yield unusually small, the latter a remarkably abundant production.

This average result of sixteen annual experiments is interesting and instructive, tending to show—indeed actually showing—that English soil unmanured, though thoroughly tilled, yields little more than the average product of unmanured American soil indifferently tilled. It also teaches the necessity, as well as the profit, of liberal manuring. The increase effected by barn-yard manure was 138 per cent., and by the application of various fertilizers, 148 per cent—in bushels, respectively, 20¾ and 21½, worth, at average rates for the period, at least $25 and $27. This is far more than the cost of the fertilizers, leaving a rent-paying profit. Our own wheat-growers should ponder these results and profit by them.

INDIAN CORN.

FERTILIZERS COMPARED.

John May, of Winthrop, Maine, on 84 square rods, fertilized with 4½ loads of barnyard manure and a tablespoonful of Coe's superphosphate in each hill, grew 39 bushels of corn and other products, costing $38, and worth $69 60.

Another correspondent states that he has been in the habit, every few days during the fall and winter, of spreading dry muck over the droppings from his hen-roosts. In the spring his hen-house afforded him a pile of excellent home-made guano, which was shoveled over several times, becoming finally pulverized, and no more unpleasant to handle than dry earth. It was used on a late piece of corn, a handful in each hill. The corn soon caught up with that planted ten days earlier, ripened quite as soon, and gave a better yield. It grew so fast that the cut-worm could make no impression on it.

E. R. Townley, of Vermont, reports the following experiment: The land and cultivation were uniform—inverted greensward, heavily manured on the surface. The fertilizers were put in the hill. Each plot contained two rows through the field. Plot No. 1, not manured; product, 2¼ baskets of ears of corn. No. 2, fertilized with a compost of hen-manure, ashes, plaster, and earth; product, 2½ baskets. No. 3, Lodi Manufacturing Company's poudrette; product, 3¼ baskets. No. 4, rotten barn-yard

manure; product, 4½ baskets. No. 5, hog manure; product, 5 baskets. No. 6, Bradley's XL superphosphate; product, 5 baskets. The degree of soundness was in proportion to the yield, the last being best.

"J. M. M.," Raynham, Massachusetts.—Land poor, gravelly, and moist; was turned over in September, but no manure spread. May 25, five rows of corn were planted, fifty-five hills in a row, the hills four feet apart each way. Row No. 1: a large shovelful of first-rate manure was put in each hill; product, 81 pounds of corn, of which five pounds were unsound. No. 2: no manure; product, 49 pounds, of which 6½ pounds were unsound. No. 3: one and a half bushels compost of plaster, ashes, and hen-manure; product, 64½ pounds—4½ pounds unsound. No. 4: twenty pounds superphosphate of lime, thoroughly mixed with the soil; product, 71½ pounds—2½ pounds unsound. No. 5: one bushel Lodi poudrette; product, 62½ pounds—3½ pounds unsound. The corn was husked on the hills and the ears of each row were weighed separately. The row with manure yielded the most corn, that with the superphosphate ranking next and giving the smallest quantity of unsound corn.

Benjamin Caswell, Rhode Island.—Cultivated one acre of new ground. Spread on the sod in the spring twenty ox-cart loads of barn manure mixed with sand in the barn cellar; plowed seven inches deep; harrowed thoroughly; then with shallow furrows marked twenty-five hills to a square rod, and dropped in each hill three kernels of corn with a small spoonful of droppings from the hen-roost mixed with sand; hoed twice, grass being sown at the last hoeing; yield, 75⅝ bushels.

Experiment at the East Pennsylvania Experimental Farm.—A timothy sod plowed late in spring, put in good order, and planted May 27th. The "chemical solution" mentioned in Nos. 3 and 7 of the following table was composed of four ounces carbonate of ammonia, four ounces nitrate of potash, four ounces sulphate of iron, four ounces sulphate of magnesia, and one gallon of water. The solution appeared to do neither good nor harm. The seed employed in Nos. 1 to 4 is particularized as a light, yellow, long kernel. In Nos. 5 to 20, "a darker yellow, perhaps a little earlier."

		Distance apart of hills in feet.	No. of stalks per hill.	Gross yield per acre—pounds in ear.	Sound corn per acre in pounds.
1	Dry seed, no fertilizer	4 by 4	3	[illegible]	[illegible]
2	Seed soaked 16 hours in pure water	4 by 4	3	[illegible]	[illegible]
3	Seed soaked 16 hours in chemical solution	4 by 4	3	[illegible]	[illegible]
4	Dry seed, no fertilizer	4 by 4	3	[illegible]	[illegible]
5	Dry seed, no fertilizer	4 by 4	4	[illegible]	[illegible]
6	Seed soaked 16 hours in pure water	4 by 4	3	[illegible]	[illegible]
7	Seed soaked 16 hours in chemical solution	4 by 4	3	5,424	[illegible]
8	Whann's phosphate in hill, 200 pounds to acre	4 by 4	3	[illegible]	[illegible]
9	Hewes's phosphate in hill, 200 pounds to acre	4 by 4	3	[illegible]	[illegible]
10	Baugh's Chicago fertilizer, 200 pounds to acre	4 by 4	3	[illegible]	[illegible]
11	Harrison's plant fertilizer, 200 pounds to acre	4 by 4	3	[illegible]	[illegible]
12	Moro Philip's phosphate, 200 pounds to acre	4 by 4	3	[illegible]	[illegible]
13	Shoemaker's phaine	4 by 4	3	[illegible]	[illegible]
14	Baugh's raw-bone phosphate	4 by 4	3	[illegible]	[illegible]
15	Bowers's complete manure	4 by 4	3	[illegible]	[illegible]
16	Hen-manure, not weighed, handful to hill	4 by 4	3	[illegible]	[illegible]
17	Dry seed, no fertilizer	5½ by 4	2	[illegible]	[illegible]
18	Dry seed, no fertilizer	3 by 4	2	5,170	4,798
19	Dry seed, no fertilizer, covered 3 inches deep	4 by 4	3	5,269	[illegible]
20	Dry seed, no fertilizer, 1 inch deep	4 by 4	3	[illegible]	[illegible]

PROPER DEPTH OF SEED.

A Pennsylvania farmer, experimenting in planting corn at various depths, planted corn with a pointed stick at depths of one, one and a half, two inches, &c., down to six inches. The grains planted at one inch came up in eight and three-quarter days. Those at one and a half inches came up in nine and a quarter days. Those at depths from two to five inches came up in periods ranging from ten to eighteen days, proportional to the depth of seed. Of those at five and a half inches, only ten grains came up. Those at six inches did not make their appearance at all. Of those at five inches only forty-two grains attained a height of six to eight inches. Those planted at the depth of four and a half inches produced no ears of full size. Those at one and a half inch produced far the best corn. Those at one and two inches gave sound ears, but inferior to those just mentioned. He concludes that the proper depth for planting corn is from one and a half to two inches. This may stand as a general rule, but it cannot be made an absolute guide, in view of the conditions of diverse soils.

ROOT CULTURE.

EXPERIMENTS IN TURNIP CULTURE.

The prominence of root culture in the agricultural system of Great Britain is well known, though the value of the product and the quantity obtained per acre by good culture in a favoring climate are not fully understood. In the Transactions of the Highland Agricultural Society of Scotland for 1868 is published a report of experiments made by Mr. Henry Shaw, with different varieties of turnips. Upon this result a gold medal was awarded to him by the society. The field on which the experiments were made had a southern exposure, about seven hundred feet above the sea level, its soil being a light loam, dark in color, especially adapted to grass and turnips; the subsoil, a strong, brownish clay. The land had been subjected to a six-course rotation; one year in mowing, three in pasture, followed the fifth year by oats, and the next year by turnips. Sixteen varieties of turnips were sown in plots measuring one-eighth of an acre each. Each of these allotments was manured with two and a half cubic yards of farm-yard dung and twenty-eight pounds of dissolved bone; excepting the plots sown with Swedes, whereon this quantity of dissolved bone was doubled, the amount of dung being the same. The product per imperial acre is given in the accompanying table, fractions of hundred-weights not reported:

Kind.	Product.		Kind.	Product.	
WHITE TURNIPS.	*Tons.*	*Cwt.*		*Tons.*	*Cwt.*
Common White Globe	25	15	Old Meldrum Yellow	24	3
Tankard Globe	24	10	Tweeddale Purple-top Yellow	21	2
Pomeranian White Globe	26	00	Aberdeen Purple-top Yellow	21	15
Graystone Globe	25	19	SWEDES.		
Red-top Globe	25	4	Bangholme Swede	19	18
YELLOW TURNIPS.			Bronze or Kinaldie's Swede	19	14
Early Bullock Yellow	23	15	Shepherd's Swede	21	7
Aberdeen Bullock Yellow	23	2	Skirving's Improved Swede	20	6
Dale's Hybrid Yellow	22	6	Skirving's King of the Swedes	19	15

Mr. John Milne also received a gold medal from the Highland Society for experiments made during three consecutive years on a farm in Aber-

deenshire, designed to test the comparative productiveness of varieties. The field had a light soil, suitable to turnips, resting on a clay slate; and had been subjected to a five-course rotation. In each case the manures applied per acre were fifteen yards of farm-yard dung, one hundred-weight of Peruvian guano, two hundred-weight of bone-dust, and two hundred-weight of superphosphate. The results are given by Mr. Milne in tons and thousandths of a ton. The abstract here presented is confined to varieties of Swedes:

Varieties.	1864.	1865.	1866.
	Tons.	*Tons.*	*Tons.*
Drummond's Extra Improved	15. 804	12. 051	16. 850
East Lothian	15. 804	11. 787	14. 250
Green-top	12. 946	12. 402	14. 700
Laing's	16. 606	10. 075	13. 150
Bangholme	16. 563	13. 001	....

The report states that the turnip degenerates, if sown for a few successive years on poor, unmanured soil, from a large fleshy bulb to a small, elongated fibrous root; and years of careful cultivation are required to restore it to its former value. Hence the use of seed grown for a series of years from full-sized, transplanted bulbs is urged; and it is claimed that the difference in productiveness between two varieties, or two samples of the same variety, may be wholly owing to the method in which the seed has been raised.

Mr. Russell Swanwick, in 1865, made experiments showing the effect of different fertilizers for turnips. The soil experimented on was a moderately heavy loam. The previous crop was wheat. The dressings were sown May 27, in drills, which were then ridged in and sown with white globe turnip seed. The turnips were pulled and weighed in the last week of November. The following table states the manures applied, and the yield, per acre:

Manures.	Amount of manure applied.	Yield of turnips.	Manures.	Amount of manure applied.	Yield of turnips.
	Cwt. Lbs.	*Tons. Cwt.*		*Cwt. Lbs.*	*Tons. Cwts.*
None	....	12 17	Bolivian guano	3 24	16 0⅓
None	....	12 18⅔	Sal ammoniac	1 105	17 11
Glue Dissolved coprolites	2 70 5 70	16 8½	Sal ammoniac Bolivian guano	1 105 3 24	17 4
Glue Dissolved bone-ash	2 70 5 70	16 11½	Sal ammoniac Dissolved bones	1 105 5 87	18 3
Glue Dissolved bones	2 70 5 87	16 16⅔	Sal ammoniac Dissolved bone-ash	1 105 5 70	17 10⅓
Glue Bolivian guano	2 70 3 24	16 10⅓	Sal ammoniac Dissolved coprolites	1 105 5 70	16 18⅔
Glue	2 70	16 9½	Twelve tons of dung Three cwt. of guano	....	13 14⅔
Dissolved coprolites	5 70	13 5¾			
Dissolved bone-ash	5 70	14 9			

ROOT CULTURE IN MARYLAND.

Many have doubted the desirability of attempting root culture in this country, south of forty degrees north latitude. It has been found a prolific and profitable culture in many localities. Mr. George F. Armor, of Ellwood, Baltimore County, Maryland, communicates the following result of an experiment in the culture of the mangold-wurzel, undertaken to test the profit of such a crop in that neighborhood. The yield, as will be seen, was something more than four bushels to the square rod,

or about 700 bushels per acre, produced at a cost of a little more than ten cents per bushel:

"I had a piece of ground prepared, 15 by 120 feet, southern exposure, slightly rolling, but inclined to be wet. After plowing and manuring, (with stable manure,) the seed was run in drills three feet apart, making six rows 120 feet long, on or about May 10. Upon thinning out enough plants were cast away to have run at least twelve rows additional. The roots were gathered November 8, and the result was twenty-eight bushels. The tops I fed to the cattle, and they were eaten with great avidity, and the roots were greatly relished. So far as I can judge from so limited an experiment, the result is highly satisfactory. The whole cost, including twelve ounces of seed, (Long and Yellow Globe mixed,) at $1 per pound, three cultivatings, with use of horse, does not exceed $3, or about $72 per acre."

GRASS AND HAY.

In the report of the Royal Agricultural Society of England for 1867, Professor Voelcker states at considerable length the results of experiments instituted by him some years ago at the Agricultural College, Cirencester, on a level clover field of calcareous soil, both by nature and condition of tillage well adapted to this plant. The experiments were especially directed toward establishing the proper period for cutting the hay crop. Twelve plots were set apart, each measuring one rod square. On these plots cuttings were made at different periods from May 26, to July 28; some of them being mown from two to four times each, others only once. The cuttings were analyzed in such manner as to exhibit in each case, 1st. The weight of the fresh-cut clover; 2d. The weight of the hay made therefrom and cured to a uniform standard, containing 16.7 per cent. of moisture; 3d. The percentage of nutritious elements contained in this hay. By estimate from the product of a first cutting made June 16, the yield of hay per acre at that period was 7,557 pounds, being the greatest quantity obtained at any one mowing. Analyses of the cuttings of the different periods show furthermore that at this time the hay contained the greatest proportional amount of nutriment. In the plots first cut at dates earlier or later than that just mentioned, deficiencies in quality and total yield were in approximate proportion to the differences of time observable between said dates and the period of best production, namely, June 16. As an indicatory example, Plot No. 5 was first cut June 2, yielding 5,372 pounds of hay, and again mowed June 16, yielding 102 pounds. Total yield of Plot No. 5, up to date of June 16, 5,474 pounds; thus exhibiting, when compared with No. 7, not only a deficiency in average quality, but also a deficiency in quantity of at least 2,083 pounds.

Deduction: Cut at the period when the clover plant contains its greatest proportion of nutriment, and before the ripening of the seed. A current agricultural rule expresses the principle: "Cut when one-half of the heads are browned." A like principle is involved in the cutting of the other grasses.

CURING HAY.

F. V. Stewart, Farmington, Maine, states that his practice has been to commence cutting the grass when in "the second blossom," which occurs generally in his section from the 10th to the 15th of July. He begins mowing with the machine as soon as the dew is completely off, and about one o'clock commences to rake and haul in, following the

course of the machine, and getting all in before the dew begins to fall. Each subsequent day's gathering is put on the same mow until the band is full, and at the top of the mow a layer of straw or old hay is placed one and a half foot deep. Mr. Stewart claims that this absorbs the moisture given off by the heating process, and that the hay is bright, sweet, and of delicate flavor, and is especially sought by stock. He states that he has never known a failure where this plan was closely followed, and if attempts prove unsuccessful it must be that there was dew on the grass when cut, or that it was cut at too early a stage of growth.

At the industrial College of Maine, situated at Orono, in that State, four tons of hay, chiefly timothy and red-top, were put in one mow with "no making, and no foreign moisture in the grass." Old straw to the depth of a foot or more was pitched on the top of the mow. The result was a complete loss. The hay was cut July 18, about 11 a. m., and hauled into the barn about 2 p. m. The qualification of "no making" sufficiently explains the result.

B. F. Reed, of Greene County, Ohio, stated in the district agricultural convention, that he stored his timothy and clover in the barn, quite green, making chimneys, so to speak, in the mow, by putting barrels on the mow floor and drawing them up as the hay was stowed about them, thus leaving ventilators which permit air to pass through the hay and cure it in the mow.

LIQUID MANURE ON GRASS LAND.

Two experiments were made by J. V. Howill, Cherry Valley, Pennsylvania. The first was on pasture, the soil sandy, subsoil sandy gravel, and perfectly dry. Four acres of the field were dressed in February with excellent barn-yard manure, at the rate of twelve two-horse loads per acre. The remainder of the field (about an acre) was manured with liquid from the barn-yard. In the spring, the appearance of the grass, in color, height, and thickness of the sward, was in favor of the liquid manure, and during the summer this acre was greatly preferred by the cows. In the second experiment, a small portion of the field was manured with a compost of night soil and wood-mold, and the remainder with liquid manure; when the lot was mowed, the line between them could be easily traced, and the difference was strongly in favor of the liquid manure.

DRY AND WET MEADOW.

The secretary of a "social farmers' club" in Pennsylvania narrates the experience of three members of the club. The several statements will be designated A, B, and C.

A.—A meadow of forty acres was brought into fine condition by draining wet portions, paring down tufts of coarse grass, and then administering a dressing of lime, followed by a light one of bone-dust. Subsequently a portion of the meadow was dressed with a light coat of superphosphate and cut for hay, of which nine tons of excellent quality were obtained from seven acres. The cattle were kept from the low meadow whenever it was very wet. Great benefit was derived from the application of ground plaster to the dry meadow, but not from its application to the wet.

B.—A meadow of twenty acres was divided into plots running the whole length of the meadow, each containing wet portions as well as

dry, and each evenly prepared throughout its entire length with a special fertilizer. At the end of four years the results are reported. The subjoined table indicates the application made to each particular plot, (with the cost per acre so far as given in the original narration.) and the effect exhibited on the dry and on the wet portions of each plot. The figure 1 is used as the index of best production; 2, as that of second in excellence, &c.:

Fertilizers.	Cost per acre.	Dry meadow.	Wet meadow.
Salt and lime	....	1	2
Superphosphate	$4 50	2	5
Bone-dust	4 00	3	3
Salt	2 25	4	4
Caustic lime	3 50	5	1
Guano	5 00	6	6

The salt and lime were in the proportion of three bushels of salt to five of lime, mixed about three months before use and afterward shoveled over several times. It was applied broadcast at the rate of eight bushels per acre.

C.—About ten years ago a "fine, large meadow" was divided into two portions, the one dry, the other wet. The former was subdivided into several plots. One of these was dressed with caustic lime at the rate of twenty-five bushels to the acre. The other plots were dressed with air-slacked lime in quantities varying from twenty bushels to sixty bushels per acre. That treated with caustic lime has always produced the best pasture since the fall following the time of application. In the wet portion was included a "low, wet flat." It should be remarked that in the report made respecting this portion, a serious omission occurs, as the statement of effects seems to be confined to recent appearances, and does not point out relative states from season to season. Subdivisions of this low, wet meadow were treated with various fertilizers. The following applications made to seven of the plots are named in the order of best effect, commencing with the first in excellence: 1, caustic lime, at $3 25 per acre; 2, an animal compost formed of the carcass of a dead horse, a load of rough hair, earth, and common plaster; 3, salt, at $3 per acre; 4, superphosphate, at $5 per acre; 5, guano, at $5 per acre; 6, plaster and salt; 7, nothing.

The wet meadow of B, and the "low, wet flat" of C, appear to exhibit similar conditions, prominent among which is a sour and stagnant state of soil. Against this condition the caustic lime proves a powerful remedy, (especially when accompanying draining,) attacking injurious bog-acids, forming new combinations with them, and thereby setting free valuable elements of nutrition which had previously been held inactive. In the dry meadow of B, the salt and lime mixture stands first, as the sweetening effect of the lime is there not needed in so great degree. In the dry meadow of C, however, there appears to have existed an acidity which required the action of caustic lime. In B, as well as in A, is indicated the necessity of discrimination in the use of plaster as being suitable rather to dry than to wet soils. A also points to the avoidance of kneading wet meadow by the tread of cattle.

MICHIGAN COLLEGE EXPERIMENTS.

The experiments of the Michigan Agricultural College in top-dressing grass land in the years 1864–'65–'66 are reproduced here in concise form,

for purposes of comparison. The soil was a light sandy loam; the area, three and six-tenths acres, divided into eight equal plots. The whole was seeded to timothy and clover in 1863, and received no other manure than the below-named top-dressings, which were applied May 10, 1864. No subsequent application was made. Plot No. 1 was not manured. The following table exhibits the top-dressings applied to the other plots, and also the gain of these manured plots over the unmanured in weight of hay produced. Plot No. 1, not manured, yielded in 1864, (two crops,) 4,598 pounds; in 1865, (two crops,) 2,755 pounds; in 1866, (one crop,) 1,389 pounds—total, 8,742 pounds.

Plot.	Gain in pounds of manured over unmanured.				Total per cent. gain.	Top-dressings, 1864.
	1864.	1865.	1866.	Total.		
2	2,375	1,778	331	4,484	51	2 bushels plaster.
3	2,894	1,058	213	4,165	48	5 bushels wood-ashes.
4	3,274	1,409	391	5,074	58	20 loads pulverized muck.
5	3,063	2,245	769	6,077	70	20 loads muck, 3 bush. salt
6	1,682	2,503	1,042	5,227	60	3 bushels salt.
7	1,788	3,245	1,211	6,244	71	20 loads horse-manure.
8	2,189	2,689	944	5,822	67	20 loads cow-manure.

The top-dressings were applied on the young growth of clover and timothy. At the outset the land was in fair productive condition, as is shown by the yield of the plot not manured. The "twenty loads of horse-manure," though not giving so large an immediate yield as some of the other dressings, was the most lasting in effect and gave the greatest total yield. The "twenty loads of muck and three bushels of salt" gave a very large percentage of immediate gain, (indeed the largest percentage in the *first* crop of 1864,) and stood only second in rank as respecting total yield. Considering the cost of application, the final results of the "three bushels of salt" are especially noticeable, although in immediate productiveness it ranks comparatively low; for instance, as regarding the respective gains of the several manured plots over that not manured, in the first crop of 1864 the salt stood sixth in rank, and lowest in rank in the complete yield of that year. The "twenty loads of pulverized muck" gave the largest percentage of gain in the complete yield of the two crops of 1864, but stands third in rank in the total of the five crops, 1864–'65–'66. The "five bushels of wood-ashes" stands third in rank in the complete yield of 1864, and lowest in rank in the final summing-up.

RECLAIMING OLD PASTURE.

Renovation of an old hill pasture by Professor Johnson, of Yale College.—This pasture had once been—twenty years ago—in tolerably good condition; but when the work of restoration commenced, ten years ago, the field was unproductive, and almost covered with low bushes and mossy growth. The bushes were cut, drains established, and lime applied at the rate of 150 bushels per acre in the autumn and winter. In the following spring the surface was scratched with a fine-toothed harrow, red-top seed sown, and a light dressing of phosphatic guano (250 pounds to the acre) applied. The field contained from five to six acres, and, before the dressing, offered scant pasturage for one cow. In the season of 1868 it afforded abundant pasturage for five cows, the growth being mainly

red-top and white clover. No further dressing has been applied. Weeds and scattered woody growth are annually cut off in August, and a good coating of grass is left for winter protection. No grazing is allowed after the 25th of October. In commenting on the course pursued, Professor Johnson remarks that the pasture had evidently been slowly undergoing a change in its chemical constitution—hardening in some such manner as "hard-pan" forms in ocherous soils. The earth being compacted also by the tread of cattle around springs which existed on the slope, the flow of water was checked and the soil became moist and spongy. The remedial action of the lime was both mechanical and chemical. The soils of the neighborhood are ferruginous, and the opinion is expressed that the hardening of the land had, for the most part, been caused by the existence therein of oxide of iron and of acids resulting from a peaty decomposition of vegetable matter.

FEEDING STOCK.

Mr. William Birney, Springfield, Massachusetts, commenced ten years ago the practice of cooking food for stock. The present winter (1868) he feeds forty-three head of neat stock, equivalent to thirty-four mature animals; also three working horses, three three-year-old colts, and three yearling colts. The food is cooked in a large steam-box, holding, for instance, 1,350 pounds poor average quality of hay—two-thirds bog or marsh hay—112 pounds wheat shorts, and 44 pounds cotton-seed; 200 gallons of water are poured on previous to the steaming, which takes five or six hours, and requires 125 pounds of coal. Steaming is done only twice a week, the food keeping warm three or four days in the box, even in the coldest weather. Twice a day the requisite quantity of material is taken from the box. The horses, when at work, receive four quarts of corn each per day, sprinkled on the steamed food. Each milch cow has also two quarts of wheat shorts per day. Roots fed raw are also administered. The stock is kept in good condition, carded and combed. The temperature of the stable is always above freezing point. A statement of the cost of the food is given below. The coal is charged to general account; were it added to the following items it would not increase the average daily cost to seventeen cents:

1,350 pounds poor hay, at $12 per ton	$8 10
112 pounds bran	1 90
44 pounds cotton-seed meal	99
Total cost of steamed food for three and a half days	10 99

Cost for one day, steamed food	$3 14
Extra meal for three horses, 24 pounds	60
Extra shorts for twenty cows, 70 pounds	1 19
12 bushels roots, at 16⅔ cents per bushel	2 00
170 pounds of hay, at $20 per ton	1 70
Daily cost of feeding 52 animals	8 63

Average cost, 16⅗ cents.

The 170 pounds of good hay is for noon lunch—four or five pounds to each animal, on an average.

FERMENTED AND COOKED FOOD.

A comparison between fermented and cooked food is given in the following experiment: Four heifers, practically equal in all respects, and six pigs, from one family, were selected. The ten animals were separated into equal lots by alternate choice, and were weighed at the commencement of the experiment and weekly during its continuance. Those in the one lot were fed with fermented food; the others with cooked food. During the first week the amount of fermented food eaten was less than the quantity of cooked food consumed, and the animals fed on the fermented material made the greater increase of live weight. During the second week those on the cooked food made a steady progress; those on the fermented food scarce any. The apparent success of the latter during the first week was actually the result of an accumulation of undigested matter in the intestines. The experiment was continued three weeks, those fed on the cooked food thriving and increasing, the others not. There was a difference in the return of the lots of pigs, in favor of those fed on cooked food, of £1 7*s.* 3*d.*

FATTENING HOGS.

Results of Experiments by S. H. Clay, Bourbon County, Kentucky.—Other conditions being similar, one bushel of dry corn made five pounds ten ounces of live pork; one bushel of boiled corn, fourteen pounds seven ounces of pork; one bushel of ground corn, boiled, made, in one instance, sixteen pounds seven ounces; in another, nearly eighteen pounds of pork. Estimating the pork at eight cents per pound, one bushel of dry corn made 45 cents' worth of pork; one bushel of boiled corn, $1 14 worth of pork; and one bushel of ground corn, boiled, $1 39 worth of pork.

Respecting these experiments, a western agricultural journal remarks that the question of the advisability of grinding and cooking food must be considered in connection with the circumstances of locality; such, for instance, as cost of grinding, expense of labor and fuel. The suggestion is made that the method practiced by many in Kentucky may be best adapted to the majority of cases in the West, viz., of turning the hogs into an unharvested field when commencing to fatten; then, after a few weeks, feeding them on corn in the ear till they are pretty well fattened; and then feeding on corn-meal till they are in prime marketable condition.

According to experiments made by the late Professor Mapes, in New Jersey, it required thirty pounds of raw corn to make as much pork as thirteen pounds of cooked meal would produce.

The purport of certain experiments with five pigs during the past year, by a New England farmer, may be exhibited by taking his statements as to pigs No. 1 and No. 5. No. 1, taken from the sow at four months of age, was supplied with two and a half quarts of corn or meal, three times a day, and about the same quantity of milk, continued as long as the pigs lived, and made eleven pounds of pork to the bushel. No, 5, other conditions being equivalent, received three and a half quarts per day, and produced seven and a half pounds of pork to the bushel. The farmer thinks he did not get so much pork as he should if he had kept the pig on three quarts per day. After experimenting for several years in feeding pigs, he holds that they should not be allowed a superabundant proportion of fluid food, but rather be treated with a regular and more substantial diet, commencing when they are taken from the sow; and

also that a certain quantity of corn or meal per day should not be exceeded.

At the Michigan Agricultural College, in 1866, experiments were made in feeding three thorough-bred Essex pigs, which were weighed when eleven days old, and afterwards allowed all the milk they would consume. The total weight of the three at the time just mentioned was fourteen and a half pounds. Similar experiments were made in 1868 with corresponding results, showing that the younger the pig the more it will eat in proportion to its live weight, and also the more rapidly it will gain in proportion to the food it consumes. The subjoined table shows the amount of milk consumed at different times, in making one pound increase in live weight:

	1st week.	2d week.	3d week.	4th week.
Experiment of 1866, lbs	7.20	7.92	11.81	10.18
Experiment of 1868, lbs	6.53	7.70	12.52	10.56

VALUES OF DIFFERENT FOOD MATERIALS.

However useful as a means of comparison, chemical analysis alone is not able to determine with sufficient exactness the values of different food materials; and a really satisfactory decision can be reached only through actual experience. The following table, prepared by Professor Tanner, of England, represents the composition of various materials used for food of animals, and their feeding value as demonstrated in practice:

Materials	Composition.			Feeding value.	
	Non-nitrogenized matter.	Nitrogenized matter, per cent.	Water, per cent.	Pounds required to make one pound of meat.	Per cent.
Barley	56	13	14.83	6	16.7
Oats	55.5	13.6	12.8	7	14.3
Beans	48.5	23.3	14.8	8	12.5
Pease	50	23.3	14.1	8	12.5
Linseed cake	43.52	28.56	8.6	5 to 6	16.7
Linseed cake and pease, equal parts	31.76	25.93	11.3	4½	22.2
Rape cake	11.3	33.7	6.8	6	16.7
Cotton cake	39.4	42.9	7.9	6	16.7
Clover hay	40	9.3	14	12	8.3
Swedes	8.47	1.44	89	150	0.66
Mangolds	8.19	1.81	86	150	0.66
Carrots	10	1.5	85	160	0.66

In actual application these estimates of value are modified by various considerations. Some of these are stated by Professor Voelcker as follows: 1st. The age of the animal; young animals, especially, requiring a large proportion of nitrogenized matter and bone-forming material. 2d. The kind of animal; (the food best suited to horses is not always best for cows or sheep.) 3d. The natural disposition or temper of the animal. 4th. The purpose for which the animal is kept—as whether for fattening, or for work, or for milk. The digestibility of the food, also, demands attention. Professor Voelcker states a few of the conditions

affecting it: 1st. The kind of animal, cows more readily assimilating the nutriment of cut straw than horses. 2d. The amount and character of woody fibre contained in the food. 3d. The amount of flesh-forming substances. 4th. The bulk of the food. 5th The form in which it is presented to the animal; whether cut, or not cut, cooked or raw, &c.

EXPERIMENTS WITH FERTILIZERS.

The subjoined statement of experiments made by Mr. Levi Bartlett, of Warner, New Hampshire, with superphosphate of lime and other concentrated manures, gives an idea of the effect of these fertilizers upon the granite soil of New Hampshire.

Within the past few years large numbers of the farmers in that section of the country have made free use of the superphosphate of lime for manurial purposes, and generally with paying results; so much so that its use is annually increasing. The reasons why a few hundred pounds per acre, applied to the land planted with corn, potatoes, turnips, beans, and clover, usually exhibit such favorable results, is supposed to be owing to the restoration, to long cultivated fields, of these phosphates so necessary in the production of cultivated crops, but which have been, year after year, abstracted from them. Each crop grown and removed from the land carries with it certain well-known mineral plant food. In the usual routine of farming pursued in the region referred to, but small portions of these mineral ingredients of crops ever find their way back to the soil whence they were derived; and sooner or later the crops diminish in product from lack of appropriate food. Potash, lime, magnesia, phosphoric acid, and sulphuric acid are absolutely necessary for the life of agricultural plants, as is demonstrated by all the experiments hitherto made for studying their influence. These, with a few other minerals, constitute the ash of plants. Were it possible for a plant to grow, flower, and bear seed, without the co-operation of mineral matters, it would be utterly valueless to man or animals, because these minerals are as absolutely necessary in the food of man and animals as they are in the soils. A deficiency of them in either case leads to a stunted growth, enervation, and premature death. Phosphoric acid and lime are indispensable in the formation of the bones of animals, and no other combination of lime and acid can be substituted. Potash, soda, sulphur, iron, &c., enter into the composition of animals in very small proportion when contrasted with the amount of phosphate of lime required to build up their bony skeletons. Professor Liebig says: "In an ox of 550 pounds' weight there are 183 pounds of bones, containing nearly 120 pounds of phosphate of lime; in the flesh, hide, and other parts of the animal, 15 pounds of phosphate." Professor Johnston says: "For every cow it maintains, a dairy farm will annually lose of earthy phosphates as much as is contained in 50 pounds of bone-dust."

A large portion of the farms in New England have been under cultivation from one hundred to two hundred years, and the phosphates required in the formation of the bones of all the animals, bipeds and quadrupeds, raised upon these farms, have come directly from their soils. By the agency of the various food-crops grown upon them during this long period, a deficiency of phosphates exists in the soil of thousands of these farms. This is so manifest that the most skeptical admit it.

The only feasible method of restoring the needed phosphates is by the application of ground bone, or what is better, the soluble superphosphate of lime. The above citation from Professor Liebig shows the enormous

excess of phosphate of lime in animal structures over all other of the inorganic constituents entering into their composition. Something analogous holds good in the inorganic constituents of certain cultivated crops, especially the cereals. The mean results of thirty-two analyses, by Professors Way and Ogston, show that "wheat contains some lime, but only very little, much less than is generally supposed, not more than one ounce in a bushel of grain (and a little more in the straw,) while it contains rather more soda than lime, about five times as much magnesia, nearly nine times as much potash, and more than thirteen times as much phosphoric acid." This acid is found in the ash of plants in combination with lime, potash, soda, &c.

These prefatory remarks are made with especial reference to the beneficial action of a good superphosphate of lime on the long-cropped soils of New England. Such applications are not needed on the fertile soils of the West, which have been under cultivation but a few years. But the time will come, sooner or later, when many of these productive lands will feel the want of the phosphates which have been so lavishly drawn from them year after year in their wheat and corn crops, with no adequate returns of manure of any kind.

Some may ask, "Can the fertility of annually cropped soils be kept up by the application of superphosphates and other concentrated manures?" Perhaps it may, but the safer way for the farmer is, to use these commercial manures in conjunction with the farm-yard and other manurial resources of the farm. This is the course pursued by many of the most successful cotton growers of Georgia, some of whom annually expend thousands of dollars in the purchase of guano and other commercial manures. A similar course is pursued by the wheat and root growing farmers of England.

Carefully conducted experiments, by Mr. Lawes, of England, on manuring grass lands, with a great variety of manures, animal, vegetable, and mineral, indicate that, practically speaking, stable or farm-yard manure is a much more perfect and economical restorer of the constituents removed in the hay crop than are the so-called artificial manures. But experience shows that, even when farm-yard manure is used, activity of growth is frequently increased if direct phosphatic manures be also employed. Phosphoric acid may be advantageously and economically applied either in the form of Peruvian guano, which at the same time supplies a large quantity of ammonia or ammonia-yielding matter, and a little potash also, or a superphosphate of lime. Mr. Lawes says: "There can be no progressive agriculture without farm stock; consequently, without stock, no manures."

Mr. Bartlett's report of experiments is as follows:

"Having the past season experimented with several different brands of superphosphates and other concentrated manures, I herewith report the results. Wishing to test the worth of various manures on different crops on my farm, about the 20th of May I turned over, with a good plow, ninety rods of green-sward, a fair quality of corn-land, a part of which was planted with a small variety of eight-rowed corn. The rows across the land contained twenty-two hills each—hills three by three feet apart. The first two rows had a small spoonful of Duncan & McKellar's Glasgow Company fertilizer applied to each hill—yield, 38 pounds; two rows Cumberland, Portland, Maine, 36 pounds; two rows Rhodes & Co.'s ammoniated, 40 pounds; Rhodes' standard, 37½ pounds; two rows of Andrew Coe's, 34 pounds; two rows Coxsackie, New York, 33 pounds; two rows mineral superphosphate, 39 pounds. All of the above-named were superphosphates, equal quantities of each applied in the hill, and

slightly covered with soil before dropping the corn. Two rows of ashes and fine bone-dust, wetted with water six weeks previously, yielded 30 pounds; two rows, fine hen-dung, 36 pounds; two rows Peruvian guano, 30 pounds; two rows, hen-manure and dry ashes, 36 pounds; two rows, fish-pomace or guano, 27 pounds; two rows, sulphate of ammonia, (put too much in the hills—some of the seed failed to come up,) yield, 24 pounds; two rows, one-third of each having Cuban guano, Alta Vela guano, and Baker's Island guano, yield, 34 pounds; two rows, seed soaked in the 'French liquid fertilizer' for 24 hours previous to planting, yield, 26 pounds; two rows, without manure, 25 pounds. The corn was husked in the field October 20, each two rows weighed soon as husked, and noted down as above. Soft corn there was none; the smallest nubbins were thoroughly ripened. I do not think the above is a perfectly fair record of the intrinsic value of the different manures, for the cut-worms destroyed many plants in some of the rows, and a heavy shower, attended with wind, about the time the corn was fairly in the milk, prostrated a portion of it, thereby much lessening the yield.

"Some of our farmers, who experimented with different brands of superphosphates on corn, on different and better corn-soils, realized different and much more favorable results; and so pleased are they with these results that they will purchase largely of superphosphates for their corn and other farm-crops the coming season.

"The remainder of the ninety rods of land was planted with the Orono potato—planted 26th of May; rows twenty-two hills long. The four south rows received a spoonful of Andrew Coe's superphosphate to each hill; fifth row, no manure; then four rows, Portland superphosphate; next row, no manure; every fifth row without manure; four rows, hen manure; four rows, fish guano; four rows, Coxsackie phosphate; and so on, till the field was planted. The four rows without manure through the field averaged two bushels, each set of four rows not varying over half a peck; the manured rows averaged three bushels, varying with the different manures to each four rows from two and a half to a little over three bushels—the fish guano giving the largest yield and fairest tubers.

"Another plat of sixty rods, green-sward, soil sandy loam, was planted with Orono potatoes 26th of May. The following kinds of manures were used, a spoonful in the hill, viz: Duncan & McKellar's phosphated guano, Rhodes's ammoniated, and his standard superphosphate, Peruvian guano, fish pomace, hen manure, Portland superphosphate, ashes, and fine bone-dust—four rows of each, and four rows without manure; the remainder of the patch nearly a repetition of the foregoing. The result may be summed up in a few words. The yield of the manured rows varied somewhat, but the increase, as a whole, where the manures were used, was fully fifty per cent. over the unmanured, The Peruvian guano gave the largest yield, but the tubers were much more prongy and misshapen. Potatoes at harvest-time were worth about 75 cents per bushel; at that price, I think, the commercial manures used paid well. The whole season was a very wet one; perhaps in a very dry season the result might have been different. I planted some twenty rods with the same kind of potatoes on highly manured land, in corn the previous year; the potatoes were very large, misshapen, prongy tubers, badly diseased, and of poor quality for table use.

"On corn, where a fair dressing of manure was applied, phosphate sown broadcast and applied in the hill, increased the crop, and very much hastened its ripening. On white beans, it doubled the yield, and hastened the ripening at least ten days."

EFFECTS OF GUANO BURIED AT DIFFERENT DEPTHS.

Recent experiments made by the Agricultural Society of Prague show the effects of guano buried in the soil at different depths. The amount applied was 290 kilograms per hectare. This is 259 pounds per acre.

Depth of application.	Product per hectare, (first year.)			Product per hectare, (second year.)			
				Without new manure.			With new manure.
	Winter wheat.	Winter rye.	Oats.	Oats.	Winter rye.	Winter barley.	Winter barley.
	Kilogr.	*Kilogr.*	*Kilogr.*	*Kilogr.*	*Kilogr.*	*Kilogr.*	*Kilogr.*
1. Put in with the seed	2,590	2,203	7,402	3,966	3,349	1,658	2,627
2. From 1 to 2 inches	2,644	2,203	7,402	3,613	3,525	1,7[illegible]4	2,654
3. From 2 to 3 inches	4,142	2,677	7,843	4,886	3,877	2,115	2,655
4. From 3 to 4 inches	4,670	2,590	8,108	5,025	4,239	2,908	3,264

INSECTS.

EXPERIMENTS WITH THE POTATO BUG.

Edwin Reynolds, correspondent of the Department at Fond du Lac, Wisconsin, writes as follows of his experience with the potato bug:

I planted potatoes May 7 and 8; the field thirty by eight rods; planted east and west. In the centre I planted ten rows of early varieties, which came up much sooner than the main field, and some days earlier than the Early Goodrich, planted side by side at the same time. On the 26th full-grown bugs (two) made their appearance, the field being eighty rods from where potatoes had been before; 27th, ten were destroyed; 28th, thirty; 29th, sixty-seven; 30th, thirty; 31st, fifteen—up to which time all were on about a rod of ground. June 1, two other small spots were infested, when I came to the conclusion that the price of potatoes was eternal vigilance. Therefore, with two paddles in hand, I scrutinized every hill myself, destroying bugs and larvæ until the 22d, when the larvæ that I had overlooked became crawling slugs and so numerous that I resorted to a pan and stick, knocking them off and destroying them. This I practiced until July 5, when I was told by a farmer from Iowa that one pound Paris green and four pounds dry ashes sifted and well mixed, applied to the infested vines while the dew was on, was sure death to the bugs and no injury to the vines. I tried it, and to my great satisfaction found it to be so. I used the composition, passing over the field twice a week, and kept the bugs subdued until the leaves had become too tough for their food, and they have disappeared.

It will be noticed the bugs appeared in my field in patches. Many conjectures arose in my mind, as to whether they were deposited in the ground last fall, or flew in the night from one field to another. I came to the former conclusion, for had they flown in the night they would have been more evenly distributed over the field.

I would recommend planting in fields of long narrow strips, and, at least once in two rods, plant the earliest varieties across the piece, that the bugs in the ground may be destroyed before the main field is up, as they will surely concentrate on the earliest varieties. I would further recommend that planting be done with single eyes, say five in a hill, that they may grow single stalks, in order to more closely detect the larvæ, as they are deposited on the under side of the leaves.

The most convenient method of destroying the bugs is by using a pair of tongs made of nail-rod. With such an instrument bugs and eggs can be kept off for some time with as little labor as using the Paris green and ashes, and saving the cost of the pigment.

A neighbor of mine planted potatoes on ground that grew potatoes the year before, and when covering them found from three to seven full-grown bugs on each potato.

ANTS AT THE ROOTS OF FRUIT-TREES.

Rev. W. P. Smith, M. D., of Fayetteville, Texas, communicates the following successful mode of dealing with ants at the roots of fruit-trees,

which insects are very troublesome and destructive, particularly in warm climates:

"I was raising some tobacco, and operated with the green leaves in the following manner: I removed the earth from around the tree or vine as much as I could without injuring the roots; then I put a handful of tobacco leaves around the tree or vine, where the ants worked, covered them nicely with the earth, and pressed it well. In a few cases I had to repeat the dose, but I have tried it often with uniform success in driving the ants and saving the tree or vine."

It will be seen that the foregoing collection embraces a large variety of experiments from the skillful and careful field-trial down to that which is comparatively crude and incomplete. However imperfect many of these experiments may appear, taken collectively they furnish material for practice, thought, critical comparison, and profitable deduction. Experiments even of small value in themselves may serve by example as stepping-stones to others of more perfect character, affording more decisive conclusions. It is by the constant accretion of knowledge gained through similar trials, and by the slow progress made through conflicting successes and failures, that improvements are established and errors overcome.

It is important to note some of the requisites to the clear statement of a field experiment. The narrator should specify the nature of the surface soil, whether clayey or sandy loam, porous or compact, wet or dry, and its depth; the nature of the subsoil; the manures applied, in what manner applied, and in what quantity per acre or square rod, &c; the quantity of seed sown to a given area, of what particular variety, and in what manner sown; the manner of cultivation; the cost of production; the amount of product to a given area, and its value. It is, of course, impossible to prescribe an unvarying form of statement suitable to all cases. Common sense and reflection will supply means of adaptation. It is the plain statement of facts that is wanted, not elegance of style. The farmer who contributes such desirable information may in that act be a benefactor to himself, to his immediate section, and to thousands remote from his own habitation. It should never be forgotten that, in its proper estate, agriculture is indeed an art; and that its followers, wherever they be and in whatever condition, are bound by the most common ties of humanity to contribute as far as possible to the general welfare of their fraternity.

CURRENT FACTS IN AGRICULTURE.

FOREIGN PRODUCTION.

The Journal of the Royal Agricultural Society of England contains an exhibit of the product, imports, and consumption of wheat in the United Kingdom of Great Britain during a period of years, in which the following conclusions are reached: There has been a reduction in the area of wheat culture in each of the three main divisions of the kingdom; very large, proportionally, in Scotland and Ireland, comparatively small in England. In yield there has been a small increase per acre in England and Wales, and probably in Scotland, and a marked diminution in Ireland; on the whole, a small increase in yield per acre in the United Kingdom collectively. In the aggregate of home-produced wheat in the United Kingdom there has been a diminution: proportionally small in England and Wales, very considerable in Scotland, and still greater in Ireland. The imports of breadstuffs have increased enormously of late years, and in much greater proportion in Ireland than in Great Britain. The aggregate amount of wheat consumed annually in the United Kingdom has increased very considerably, the ratio of increase being about the same in Great Britain as in Ireland. In the United Kingdom collectively the population has increased considerably notwithstanding a diminution in Ireland; and the actual consumption of wheat per head in Great Britain has increased a little more than five per cent., and in Ireland over twenty per cent. The final deduction made is that, "unless the home product of wheat in the United Kingdom, available as human food, (which has been about 12,250,000 quarters per annum during the last eight years,) should increase, there will be required the next five years an average importation of between 9,000,000 and 10,000,000 quarters annually, or from 72,000,000 to 80,000,000 bushels." Five and a half bushels per head are given as a low estimate of the average annual consumption.

Acreage in Ireland.—The total acreage under crops in Ireland in 1867 was 5,459,702 acres; in 1868, 5,547,335 acres; showing an increase of 87,633 acres. Of the several crops the greatest increase in acreage was in oats; next in meadow and clover, potatoes, and wheat, respectively. During the same period there was a decrease of more than three per cent. in the estimated value of horses, cattle, sheep, and pigs.

Increase of acreage.—In Great Britain, in 1868, the increase of acreage in wheat, over that of 1867, was a little more than eight per cent; and over that of 1866, nearly nine per cent. In barley the increase of acreage in 1868, over that of 1867, was nearly five per cent.; over that of 1866, only four per cent. In oats the year 1868 shows an increase of acreage of only one-tenth of one per cent. over 1867, and three-tenths of one per cent. over 1866. In potatoes the year 1868 exhibits an increase of acreage over 1867 of nearly ten per cent., and over 1866 of more than nine per cent. In the number of live stock, per estimate of June 25, 1868, there was an increase in cattle in 1868 over 1867 of eight and a half per cent.; in sheep, a little more than six per cent.; in pigs, about twenty-two and a third per cent.

Yield of wheat.—Reliable English authority places the average yield

of wheat, throughout England and Wales, for a series of years, at twenty-eight bushels per acre. The average for 1868 is larger, this year having been uncommonly productive. By comparison of recent statistics with similar information obtained by Arthur Young, in twenty-six counties of England, in 1769, it appears that the average product of wheat per acre in England has increased five bushels, or nearly twenty-two per cent., during the past century. This increase has resulted from improved farming.

In the estimates presented by James Caird, the well-known English writer on agricultural statistics, the average yield of wheat per acre, in different European countries, is given as follows: In England, twenty-eight bushels; Ireland, twenty-four; Austria, Spain, and Holland, twenty-three; Belgium, twenty-one; France, fifteen and a half. With reference to this low acreage of wheat in France, Mr. Caird says that, in discussing this point with the eminent French statist, M. Léonce de Lavergne, the latter agreed with him that, apart from difference in soil and climate, the deficiency was probably to be accounted for by the fact that, while the grass and the green crops, or restorative area, of England are as two to one of grain, in France the case is reversed, the grain or exhaustive crops being there as two to one of the grass and the green crops.

In Australia the wheat crop was twenty per cent. greater in 1867 than in 1866, comprising sixty-eight acres out of every hundred acres under cultivation. The wheat crop of 1867 was, however, reduced, through red rust, to an average of four and three-quarters bushels per acre, nine and three-quarters bushels less than in 1866. All other cereals showed a comparative decline in average product.

Remarkable season.—The Mark Lane Express, reviewing the agricultural experience of England, for the year 1868, says: "A long protracted drought, with intense heat, characterized the summer. The hay crop and all esculents were materially reduced. All spring corn suffered, in consequence, as to yield; more especially oats. The light lands, where wheat was grown, gave but a scanty produce, and fears were entertained that all soils would materially suffer. Those fears soon gave way upon examination of the standing crops, and the result has been the largest and best growth of wheat known during the present century."

THE DAIRY.

The report of the American Dairymen's Association, for 1868, gives the following statement of cheese and butter factories in the various States: New York, 639 factories, to 377 of which are attached 169,812 cows, no returns being given of the number attached to the 262 factories remaining; Ohio, 72 factories, to 29 of which are attached 12,100 cows; Illinois, 26 factories, to 15 of which are attached 5,950 cows; Vermont, 22 factories, to 9 of which are attached 5,380 cows; Massachusetts, 15 factories, to 4 of which are attached 1,717 cows; Wisconsin, 8 factories, to 6 of which are attached 2,050 cows; Pennsylvania, 5 factories, 930 cows; Kentucky, 5 factories, to 2 of which are attached 500 cows; Michigan, 4 factories, to 2 of which are attached 850 cows; Iowa, 3 factories; North Carolina, 1 factory, 230 cows; Minnesota, Virginia, and Tennessee, each 1 factory. Total, 803 factories, to 441 of which are attached 199,519 cows. This statement does not exhibit the whole number of cheese and butter factories in the United States. It is known that, in 1866, there were more than 1,000; and the number has been increasing since that time.

The quality of English cheese has deteriorated during the past seven years. In the Scottish cheese there has been a very great improvement in quality. Five-eighths of the whole production of cheese in Great Britain is made in Cheddar shapes. Prominent English dairymen frankly acknowledge the merits of the American cheese factory system, and some efforts have been made toward its introduction into the kingdom. Sweden is already introducing this system within her borders.

Cheese production in 1868.—Concerning the production of cheese in this country in 1868, M. G. B. Weeks, secretary of the American Dairymen's Association, writes: "Of cheese, probably not over three-quarters as much has been made as in 1867, while the price has averaged as much as one and a half cent per pound higher—from fifteen to seventeen cents per pound for produce of good to fancy factories. There is no stock in the country. There has been, during the past season, far less complaint, by dealers, respecting bad-flavored cheese. This is, in part, accounted for from the briskness of the demand, most of the time, which leads slight faults to be passed over; but mainly because there has been more than usual attention paid to style and quality."

Comparative prices.—Corderoy's Cheese Circular for January, 1869, says: "Really fine Cheshire cheese would bring to-day 80*s.* to 86*s.*; Cheddar, 84*s.* to 88*s.*; Scotch Cheddar, 68*s.* to 72*s.*; Swedish, 60*s.* to 66*s.*; American, 70*s.* to 74*s.* These quotations have reference only to cheese of the first class; other sorts are nominal in price. Cheese of fine quality and pure flavor is in increasing demand." The following statement is given of the arrivals of American cheese for 1868, as compared with arrivals in 1867:

	Boxes.
Year ending December 31, 1868	940,924
Year ending December 31, 1867	935,512
Increase	5,412

Choice of breeds.—In the annual address before the American Dairymen's Association, January, 1868, Professor Brewer, of Yale College, remarking on failures in profitable use of imported breeds, says: "Breeds are local in their origin, and almost local in their excellencies. When we transport an improved breed to a region distant from where it originated,it must be to one similar to its home, if it would do equally well—otherwise it deteriorates; and different localities, as well as different uses, demand different breeds."

Whey.—"Butter-making from whey, can it be profitably done at cheese factories?" In the discussion of this question by the association named above, Mr. Kenney, of Cortland County, New York, stated that, in 1867, he made from 900 cows 288,781 pounds of cheese; and from the whey 9,000 pounds of butter, which sold for twenty to thirty cents per pound, amounting to more than $1,900. The process is very delicate. Mr. Kenney holds that the making of butter from whey, in connection with cheese manufacture, will pay well, if properly managed. His cheese brought the highest market prices, and the average per cow was as large as though no butter had been made from the whey.

Amount of caseine in cheese.—The averages exhibited by twenty-eight cheese factories in New York, in 1867, show that from nine and a half to ten pounds of milk were required to produce one pound of cured cheese.

Scotch axiom.—"A cow that will make less than her dressed weight of cheese per annum should be sent to the butcher."

London dairies.—In the London cow-houses the animals serve perhaps eight to ten months, yielding at first about sixteen, and at length six quarts, of milk per day. They then go to the butcher. In the better class of these cow-houses are to be seen large-framed, wide and straight-backed, and deep-bodied, short-horn cows, especially notable for size and mass, and adaptability to fattening, as well as to yield milk, and costing, perhaps, £20 to £25 each, on entering. Elsewhere small Irish and also Dutch cows are found which have cost, on entering, £13 to £15 each, and will sell, on leaving, at £10 to £12. The general practice is to buy the cow immediately after her third, fourth, or fifth calf. It may be said that the most important requisite to the sweetness of the milk produced is that the water given to the cows should be clean and good. A stranger, entering a London cow-house, during the winter, is struck with the warmth in which the cows are kept. Experience has shown that this has an important influence on their productiveness. They stand very close—one to every thirty or thirty-six square feet. The windows are closed and matted, and no thorough-draught is allowed. In this manner the shed is warmed. There is generally room enough overhead, and perhaps a tiled roof, which allows ample ventilation; and thus, where the shed is kept tolerably clean, the air is sweet enough, as well as warm. The average yield of the cows is calculated to be about 666 gallons each for the eight months. These cow-houses, however, have proved injurious both to the health of the animals and to that of the public. Many of the cows have died of disease. Some of the cow-keepers have removed their stock to farms, from which they send in their milk by rail. In particular districts of London magistrates refuse to license these sheds, and medical health officers have frequently reported their unfavorable influence on the sanitary condition of the neighborhoods in which they are situated.

London milk-dealers, in purchasing cows, invariably look to the prospect of a good future sale to the butcher, and consider, as essential to profit, a cow which will fatten, as well as give a satisfactory yield of milk.

An expert in the London milk trade says: "Very little pure milk is sold, especially to the poor." A few months ago the proprietors of the British Medical Journal obtained specimens of milk from ten first-class establishments of London, and submitted them to Dr. Voelcker for analysis. The price of the specimens was four to five pence per quart. In every instance, except one, the milk sold as pure milk was skimmed milk, diluted with water until its real value was less than one penny per quart. "The more wealthy the neighborhood, and the more showy the shop in which the milk was sold, the poorer was the article supplied."

NORTH MIDDLESEX PREMIUMS ON MILCH COWS.

The subjoined exhibit of yield of premium milch cows is condensed from data furnished by the annual reports of the transactions of the Middlesex North Agricultural Society, Massachusetts. The agricultural societies of this county have, for a long course of years, given particular attention to the milk product. The rules of this society, among other specifications, require statements of the quantity of milk given during the second week in June, and during the first week in September, except in case of winter cows, when the requirement is for the first week in March and the first week in June. No animal, on which one premium has been awarded to any owner, is ever permitted to receive the same or a less premium. The amount of premiums given for the best dairy of three cows was, in 1858, $7; and in the other years named in this statement, $10 or their equivalent, nearly. For the

best native or mixed cows, taken singly, in 1858 (No. 1,) $7. In the other years named the premium given for cow No. 1, of this description, varies from $12 to $10. Prices for animals of less merit ranged from these sums to $3.

The following statements are on premiums given for "the best dairy of three cows, raised by the exhibitor," in 1858, 1864, 1865, and 1867. No premiums of this description were bestowed in 1866 and 1868. The amount of yield is given in quarts and decimals of a quart.

Dairy of 1858, entered by Amos Carlton, Chelmsford. Cow No. 1, eleven years old, one-quarter Durham; calved about the first of November, 1857; during the second week in June, 1858, averaged 15.75 quarts per day, and during the first week in September five quarts per day; time to calve again, October 12, 1858. Cow No. 2, thirteen years old, native; calved April 20; during the second week in June, averaged sixteen quarts daily, and during the first week in September 12.86 quarts. Cow No. 3, eight years old, native; calved July 9; during the first week in September averaged 14.86 quarts per day. Daily feed of No. 1 through the winter, one and one-half peck of roots and two quarts of cob-meal or fine feed, with hay. Of No. 2, one peck of roots with hay; since calving two to three quarts fine feed. No. 3, since calving, was fed on hay, corn fodder, and pasturage.

Dairy of 1864 entered by Gilman Roby, of Dunstable. Breed, "grade Durham, mixed with Devon; and one with Ayrshire;" kept in the first of the winter on "run" and meadow hay, corn fodder and oat straw; during latter part of the winter on English hay with meadow shorts, one-half peck to one peck daily. Cow No. 1, calved June 13, and gave fourteen quarts daily during the first week in September. No. 2, calved August 31, and in the week commencing September 4 gave fifteen quarts daily. No. 3, calved March 1, and gave fourteen quarts per day during the second week in June, and 10.71 quarts per day during the first week in September.

Dairy of 1865, by Gilman Roby, of Dunstable. Premium $10. Breed of the three cows, grade Durham. Cow No. 1, nine years old; time of calving November 22, 1864, and December, 1865; gave, the last week in March, eleven quarts per day, and during the first week in June ten quarts per day. No. 2, five years old; time of calving December 17, 1864, and December, 1865; gave in the first week in March ten quarts. No. 3, four years old; time of calving, December 7, 1864, and December, 1865; gave in the first week of March 10.5 quarts per day; has suckled a calf since the first of May. The keeping of these cows was "not very different from the common lot of cows—poor pastures, poor meadows, hay, and a few shorts or cob-meal."

Dairy of 1867, entered by John C. Corbett, of Lowell. Premium $8 and diploma. Cow No. 1, seven years old in November, 1866; one-half Ayrshire, one-half native; calved April 7; during the second week in June averaged 19.36 quarts daily, and during the first week in September 13.45 quarts daily. No. 2, four years old, one-half Durham, one-quarter Ayrshire, and one-quarter native; calved November 20, 1866, and would come in again December, 1867; gave during the first week in March fourteen quarts per day; and during the first week in June sixteen quarts daily. No. 3, which was three years old July 5, 1867, calved April 23; breed one-half Alderney, one-quarter Ayrshire, and one-quarter native; gave during the second week in June 14.14 quarts per day, and during the first week in September 10.93 quarts per day. No. 1 was the mother of Nos. 2 and 3. All were kept on English hay in winter, and on common pasture in summer, with no extra feed.

The following tabulation is a summary of the statements made on premiums given by the society, in the years named, for the "best native or mixed cows taken singly." It will be seen, on a comparison and general average of these statements, that they show a decided increase as to yield of milk in later over earlier years, especially when the relative periods of the milking season and the leading circumstances are sufficiently paralleled. For instance, first premium cow of 1858, ten years old, gives during the first week in June, six weeks after calving, a daily average of 13.61 quarts, and during the first week in September a daily average of 9.55 quarts. First premium cow of 1866, ten years old, gives during the third week in February, one month after calving, a daily average of 22.6 quarts, and during the second week in June a daily average of 18 quarts. With regard to the year 1868, the cause of the relative positions assigned to the first and the second premium cows is not so clearly shown by the report as might be desired. It may be understood, however, that, as in neighboring societies, the size and form of the animal, indicating greater or less economy of keeping, the richness of the milk, and other circumstances, are taken into account in the adjudication of prizes.

Premium cows.	Age. Years.	Breed.	Time of calving.	Yield of milk per day in stated weeks. Qts.
1858.				
No. 1	10	"Mixed"	April 15	June, 1st week, 13.61. Sept., 1st w'k, 9.55.
1864.				
No. 1	......	½ Durham, ½ Alderney	April 21	Best of season, 22. Sept.—week, 16.
No. 2	9	Grade Durham	Dec. 1, 1863	Feb., 1st week, 17.79. June, do. 15. (Mar. do. 13.4.)
No. 3	4	Alderney and Ayrshire	April 7	June, 2d week, 16.11. Sept., 1st w'k, 11.
No. 4	6	Native	June 15	June, last week, 20. Sept., 1st week, 15.
No. 5	9	Native (comes in, May, 1865)	Dec. 30, 1863	Mar., 1st week, 11.81. June, 1st week, 10.
1865.				
No. 1	8	Native	September	Mar., 1st w'k, 11.07. June, 1st w'k, 14.25.
No. 2	6	Grade Durham	Aug. 30	One week, Sept., 18.57.
No. 3	4	Alderney and Durham	May 26	June, 2d week, 17.71. Sept., 1st w'k, 12.25.
No. 4	5	¾ Alderney, ¼ Ayrshire	Mar. 21	June, 2d week, 15.07. Sept., 2d w'k, 10.93.
No. 5	4	½ Alderney, ½ native	April 29	June, 2d week, 14.43. Sept., 1st week, 10.3.
1866.				
No. 1	10	Native	Jan. 21	Feb., 3d week, 22.6. June, 2d week, 18.
No. 2	10	Native	June 19	June, last week, 19. Sept., 1st week, 16.57.
No. 3	5	"Brindle"	May 30, 1865 Sept. 20, 1866	June, '65—w'k, 18. Sep.—w'k, '65, 14.29. June, 1866,—week, 4.93.
No. 4	16	Native	April 15	June, 2d week, 17.71. Sept., 1st w'k, 13.57.
No. 5	6	¾ Alderney, ¼ Ayrshire	Mar. 21	June, 2d week, 17. Sept., 2d week, 13.5.
1867.				
No. 1	......	No statement.		
No. 2	8	¼ Durham, ¾ native	Sept. 1, 1866 Oct. 10, 1867	Sept.—; Oct. (1866,) 20. June (1867,) 13.
No. 3	5	½ native, ½ Ayrshire	May 24	June, 2d week, 21.82. Sept., 1st w'k, 15.57.
No. 4	5	Native	Mar. 13	June, 2d week, 18. Sept., 1st week, 14.
No. 5	6	Grade Ayrshire	May 18	June, 2d week, 21.71. Sept. 1st week, 13.29.
1868.				
No. 1	8	½ Alderney, ½ Durham	May 30	June, 2d week, 18.43. Sept., 1st w'k, 12.5.
No. 2	10	½ Alderney, ½ native	April 3	June, 2d week, 25.5. Sept, 1st week, 15.
No. 3	3	½ Dutch	April 9	June, 1st week, 17. Sept., 1st week, 11.
No. 4	8	"Grade"	May 2	June, (month,) 17. Sept., (month,) 17.
No. 5	9	Grade Durham	May 24	June, 2d week, 14.5. Sept., 1st week, 13.

The following table represents the averages of daily yield, at the period of largest product, in the years named. In 1858 only the first premium was bestowed, similar premiums having been withheld on account of unsatisfactory statements:

Year.	Cow No. 1.	Cow No. 2.	Cow No. 3.	Cow No. 4.	Cow No. 5.	Average.
	Quarts.	*Quarts.*	*Quarts.*	*Quarts.*	*Quarts.*	*Quarts.*
1858	13.61					13.61
1864	22	17.79	16.11	20	11.81	17.54
1865	14.25	18.57	17.71	15.07	14.43	16.01
1866	22.6	19	18	17.71	17	18.86
1867		20	21.82	18	21.71	20.38
1868	18.43	25.5	17	17	14.5	18.49

Inspection of yield of the various animals at the second period of report in each respective year, which is generally equivalent to the first week of September, shows averages the relative proportions of which are similar to those exhibited at the period of largest yield.

Comparison of statements, as to the feeding of the cows, indicates an average improvement, during later years, in the manner of keeping. So far as the reports show, the two following animals appear to be fair representatives of the best feeding. The first premium cow of 1866, entered by J. P. Cummings, of Tyngsborough, yielding 22.6 quarts daily during the third week in February, and one month after calving; twenty quarts daily during one week in April, and eighteen quarts daily during the second week in June; was kept, during winter and spring, on "run" hay, corn fodder, eight quarts of shorts, and one quart of meal mixed, per day; in summer on common pasture. Second premium cow of 1868, entered by John Higgins, of Lowell, yielding 25.5 quarts daily, during the second week in June, two months after calving, and fifteen quarts daily during the first week in September; was kept in winter on good hay, with two quarts of shorts, and one quart of meal per day; in summer, on grass only.

AMERICAN DAIRYMEN IN SWITZERLAND.

American enterprise appears to be looking to other continents for new spheres of activity. A company of Americans have located a milk-condensing establishment at Cham, near Lake Zug, in Switzerland, intended to contribute to English consumption particularly. George H. Page, of Dixon, Illinois, is superintendent of the "Anglo-Swiss Condensed Milk Company." Milk from the Alpine region is celebrated for its richness and flavor. About 400 gallons are received daily from the peasants of the neighborhood, and manufactured so carefully that a specimen kept twelve months, as reported by Baron Liebig, has been churned into excellent butter.

MILK TRANSPORTATION IN FRANCE.

On the French railways the milk-can is filled full of milk, and so stoppered down that there is no room for the least motion to churn the milk and separate its buttery particles. In hot weather the can is covered with a textile wrapper which is watered with a fine sprinkler before the train starts; and in a long journey the watering is repeated at intervals. The effect of the whole system, as carried out in these and other particulars, is that the milk is conveyed without deterioration. The

police in France and Belgium are empowered to test, with a lactometer, any milk on sale in dairy or street, and to seize such as is found to be diluted.

PRESERVATION OF MILK.

The method of M. Mabrun for the preservation of milk is to warm the milk to a moderate temperature in a tin vessel furnished with a leaden tube, for the expulsion of air: the tube is then compressed and closed with solder. A committee of the French Academy of Sciences, to whom M. Mabrun subjected his process for examination, reported that the milk thus preserved possessed, six months after being put up, all the properties of fresh milk. A prize of 1,500 francs was awarded to M. Mabrun.

FRUIT PRODUCTION.

A correspondent of the Department in Niagara County, New York, speaking of the fruit crop of 1867, in that county, says that one man in Lockport was offered $1,500 for the pears grown on one acre. He sent them to New York, where they were overkept, and he realized only $1,000 for them. One school district in Newfane received over $40,000 for fruit. The sales of apples, as taken from the books of the various buyers in the county, foot up 200,000 barrels, at an average price of $2 60, making probably the most money ever received for any one crop of any kind ever gathered in the county.

Pears.—Mr. P. T. Quinn, of New Jersey, gives the following as the amount of seven years' sales of the product of a row of thirty Duchesse d'Angoulême pears, the seven years' crops being the yield of nine years: The first crop, the trees eight years old, $120; second, $139 41; third, $156 17; fourth, $202 28; fifth, $267 49; sixth, $310 20; seventh, $705; total, $1,900 55. The row, in 1868, produced ninety-four bushels of marketable fruit, which sold at higher prices on account of the scarcity of peaches.

Strawberries.—From Ulster County, New York, $100,000 worth of strawberries was shipped, in 1867, to New York markets, and at least $200,000 worth of whortleberries from the Shawangunk mountains. From $400 to $1,000 worth of small fruits was sold from an acre.

Red raspberries.—The slaty soil of Marlborough, Orange County, New York, is especially adapted to the production of the Red Antwerp raspberry. Not less than 500 acres are cultivated in the town, giving a gross product of $300,000 per annum. An acre of Antwerps in full bearing is valued at $1,000. Good Antwerp land is worth $200 to $500 per acre.

Cranberries.—An experienced cranberry cultivator states that one improved cranberry bog on Cape Cod, Massachusetts, has yielded a paying crop nearly every season for fifty years. It should be remarked that the continued success of a cranberry field depends very greatly on the readiness with which water can be flowed upon the surface or withdrawn from it. New Jersey is the chief cranberry-producing State, and, according to the official report, its bogs and "savannas" supply at least one-half of the cranberries raised in the United States. The area of these fields is constantly increasing. Ocean County, in 1867, sent into market about 45,000 bushels, mostly the product of cultivation. It is claimed that two gentlemen have, by their operations in cranberry culture, doubled the taxable property of one township in this county during the last six years.

Small fruits in New Jersey.—In the western part of Burlington County,

New Jersey, there were, in 1867, about 1,400 acres of strawberries in bearing, 700 acres of blackberries, and 150 acres of raspberries.

Peaches.—A correspondent of the Department, in Newcastle County, Delaware, says: "The peach flourishes finely, and makes our State noted for its production. It is stated that 300,000 baskets of the fruit were shipped from Middletown alone during the last season, (1867,) all produced in the lower sections of the county." "Kent county is famous for its fine peaches, immense quantities of which are shipped to New York and Philadelphia in the season. Some orchardists have as many as 15,000 trees in bearing, and one claims 60,000. The average yield of a healthy, well-grown orchard is about two and a half baskets of five-eighths of a bushel, to a tree, and fifty cents per basket in the orchard is considered a paying price."

The Scuppernong.—A letter received by the Department from Louis Froelich, of Kenansville, North Carolina, November 1, 1868, says the Scuppernong gives the surest crop of grapes he has ever found or heard of in any wine-growing country, and adds: "At my old home on the Rhine we had, in each five years, two entire failures, two seasons of inferior wine, and only one perfect crop; and I have found nearly the same results in Austria, Hungary, France, and Italy, and in the northern or northwestern part of the United States. Indeed, we have not in this country a single variety except the Scuppernong which is not liable to injury from frost, or in danger of not ripening through unfavorable seasons or the various grape diseases. With this variety, however, we may calculate with certainty each year, as to both quantity and quality. It requires only one-fifth the labor and expense attending the cultivation of other varieties. The average yield for a three-year old vine is one peck; five-year old, two bushels; full grown, ten-year old vine, twenty-five bushels." Mr. Froelich has had ten years' experience in the culture of the Scuppernong grape.

Gardening in Florida.—A correspondent of the Department, in Putnam County, Florida, states that the culture of vegetables for the early northern markets, recently initiated in that State by northern men, is being attended with very flattering success. "But," he adds, "the attention of our people is mainly directed to the culture of fruits, especially those of the orange family, embracing the orange proper, the lemon, lime, and citron, all of which thrive well in this latitude. As yet, there are but few groves that have begun to bear, but the young trees of one or two years' growth promise well; and the number of those that have been set out during the past two years, between this place and Jacksonville, will not fall short of 250,000."

Michigan.—The secretary of the Lake Shore and Western Michigan Horticultural Association writes of the Grand Haven fruit region: "The upward tendency of prices in fruit lands is a sure indication of the increasing interest attached to fruit-growing in this vicinity. Large tracts of land around the city, purchased less than a year ago for \$5 to \$11 per acre, have been selling rapidly, in ten acre lots, for \$25 to \$100 per acre for fruit lands."

California products.—The southern counties of California are peculiarly suited to the almond crop. In this portion of the State, also, grows in great abundance the citron, the peel of which, when prepared, is so well known in commerce. According to a statement made a few months ago, nearly the whole production is annually allowed to rot, no attempt having been made, so far as known, toward its preservation either for general domestic use or for export.

Luscious pears, grapes, figs, peaches, melons, plums, strawberries,

lemons, limes, &c., were mentioned as being in great abundance in San Francisco market, October 15, 1868. Pears were three to six cents per pound; peaches five to twelve cents; native grapes four to ten cents.

The following items of production, in 1867, are given concerning the farm of Gen. John Bidwell, Butte County, California: Acres sown with wheat 2,000, yielding 33,751 bushels, the season having been, in some respects, unpropitious. Number of bearing fruit trees on the farm about 3,000, from which were sent to market, during the year mentioned, a hundred tons of green and fifteen tons of dried fruit.

Returns of county assessors in California for 1867 give the following items respecting fruit trees in that State: Apple trees, 2,249,473; peach, 934,621; lemon, 3,700, (Malaga and also Sicily varieties,) of which Los Angeles has 2,300; orange, 17,397, of which Los Angeles has 15,000: olive, 14,812, of which Santa Barbara has 12,000.

The foregoing returns afford the following statistics with regard to the number of vines cultivated in the State, and the product of wine and brandy: Vines, 21,372,334, of which Los Angeles had 3,838,000; wine. 1,876,429 gallons, of which Los Angeles gave 760,000 gallons; brandy, 165,360 gallons, of which Los Angeles gave 77,000 gallons. It is generally conceded, however, that these returns fall considerably short of the actual facts. The wine crop of 1868 is thought to be the largest ever made, being estimated from unofficial data as high as 7,000,000 gallons, of which the estimate for Los Angeles is 1,500,000, and for Sonoma 900,000 gallons.

Large grape cluster.—Mr. Fowler, gardener to the Earl of Stair, recently exhibited in Glasgow a cluster of grapes weighing seventeen pounds two and a half ounces—a fine white variety.

Fruit growing in Ohio.—A special committee of the Ohio Horticultural Society, on the deterioration or failure of orchard crops in that State, report that the decline of the apple crop has been pretty general throughout Ohio, though less in the lake region on the north and among the hills of the coal sections of the southeast than in other portions. Causes reported are: 1, exhaustion of the soil; 2, neglect and improper culture and pruning; 3, increasing severity of summer droughts; 4. deficiency and variability of atmospheric humidity, consequent on the disappearance of forests; 5, increase of injurious insects; 6, increase of fungous diseases. The turning of hogs and sheep into orchards was indicated as effective toward the prevention of insect ravages.

The vineyard products for 1867, in the region around Sandusky, Ohio, and including the neighboring islands, were as follows: 1,822,000 pounds of table grapes; 4,860,000 pounds of wine grapes. The average price realized from the table grapes was twelve and a half cents per pound; from the wine grapes six cents per pound; making the total value of the grapes $519,350. The average yield per acre of bearing vineyards in fair condition was two tons, value $227.

HIGH PRICES OF FRENCH VINE LANDS.

Romana-Conti, a Burgundy vineyard of three acres, producing an unrivaled quality of wine, was offered for sale, at auction, at a minimum limit of 110,000 francs, or $20,625. Also Vouzeot, a vineyard of about 134 of our acres, yielding a superior wine, was also offered at a limited price of 2,000,000 francs, or $375,000. The celebrated Chambertin vineyard realized for 1 hectare 92 ares (4.74 acres) 80,000 francs, or $15,000; for the second lot, 1 hectare 68 ares (4.15 acres) 74,800 francs, or $13,925.

WOOL AND WOOL MANUFACTURES.

Wool of the world.—Recent German estimates (approximate) give to Great Britain an annual production of 260,000,000 pounds of wool; Germany, 200,000,000; France, 123,000,000; Spain, Italy, and Portugal, 119,000,000; European Russia, 125,000,000; making a total estimate for Europe of 827,000,000 pounds; in Australia, South America, and South Africa, 157,000,000; the United States, 95,000,000 [too low;] the British North American Provinces, 12,000,000; Asia, at a very general estimate, 470,000,000; Northern Africa, 49,000,000; the aggregate production of the world being put at 1,610,000,000 pounds.

Wool growing in Russia.—As evidence of the vast scale of sheep husbandry in Russia, the following items are given from statements of Russian exhibitors at the Paris Exposition of 1867. Mr. Tilibert's flock consists of 70,000 merino sheep. In 1864 it numbered 50,000 head, which gave 476,496 pounds of wool. Michel Bernstein, of Odessa, reports a flock consisting of 400,000 sheep. The last shearing produced 1,111,577 pounds washed, and sold for 870,000 roubles, approximately $558,000 in gold.

Rank in wool manufacture.—Data obtained at the Paris Exposition of 1867 appear to justify the following classification in rank of the leading nations in card-wool fabrics: Rhenish Prussia first for men's wear; France first for women's wear; Austria second for women's wear; France second for men's wear; Belgium third for men's and women's wear; Prussia fourth for men's and women's wear; England fifth for men's and women's wear; the United States sixth for men's and women's wear; Russia seventh for men's and women's wear. Taken as a whole, France stands at the head of all nations in the manufacture of wool.

In respect to products of card-wool industry generally, practical manufacturers, who have recently visited Europe for the purpose of study, concur in declaring that in efficiency of system, processes, and machinery for fabrication, the United States are on an equality with the most advanced nations.

In the whole range of fancy cassimeres, including the mixed goods of silk and wool, in style, taste, perfection of manufacture, and strength of material, the United States excel England, and nearly approach the manufacturers of France. The same may be said of the whole range of flannels, colored, and also plain, and of the Esquimaux and the Moscow beavers, imitated from the Germans.

The United States commissioner on wool and manufactures, at the Paris Exposition of 1867, says in his report: "American carpets are fully equal, if not superior, to the English carpets of similar grades. The American retail purchaser is invariably compelled to pay a higher price for a foreign carpet of the same grade. The American ingrain carpet, which is much more largely consumed, is unquestionably superior to the English."

The same report states that, while the material condition of the English workman is vastly superior to that of workmen in France, Belgium, Prussia, and Austria, it is freely admitted that the general and technical education of the English operative is far inferior to that of the workmen of the nations above named. The Paris Exposition served to open the eyes of England to the startling fact that she had been making but little progress in manufacturing and mechanical industry since 1851, compared with that made in many other European countries. The responses of eminent men of Great Britain, to a request for information addressed by the Schools Inquiry Commission of July 2, 1867, as touching this inferiority in

industrial arts, embody the following facts: That England has made little progress in the peaceful arts of industry since 1862; that she must, at no distant day, in virtue of the better education furnished by the continental nations, find herself outstripped by them, both in the arts of peace and war; that, notwithstanding she may still be unsurpassed in many of her productions, she no longer holds the pre-eminence accorded to her in 1851; that the rapid progress being made by continental rivals would daily render it more difficult for English woolen manufacturers to retain even their relative position. Furthermore, that the great want among English manufacturers is a proper industrial education among masters, foremen and workmen generally; and that superior continental productions exhibit, not a machine working a machine, but brains at the loom, and intelligence at the spinning-wheel. The Commissioner, in presenting these statements, cites them as advisory to the extension in the United States of such schools as the Cooper Institute, of New York, and the Massachusetts Institute of Technology. He indicates, however, another cause of English decline than that already mentioned, viz., a ruling desire for "production at the cheapest possible rate for the utmost possible consumption," causing a constantly declining standard of excellence, and continued depreciation of fabric. He characterizes such a policy as short-sighted, and points out the false economy of making poor, or, more properly speaking, dishonest fabrics.

Manufacturing in the Northwest.—At the exposition of the woolen manufacturers of the Northwest, held in Chicago, Illinois, in August, 1868, it was stated that there were, at that time, in the seven States—Ohio, Michigan, Indiana, Illinois, Wisconsin, Iowa, and Minnesota—357 woolen mills with 995 sets of machinery, from which it appears that the woolen machinery at the Northwest has doubled in less than four years.

Mills on the Pacific coast.—There are five woolen mills in California and four in Oregon.

Shoddy.—This article was first introduced into use about the year 1813, at Batley, in the West Riding district, Yorkshire, England, and now forms one-fifth, by weight, of the woolen and the worsted manufacture of the district, which is the chief seat of the trade of Great Britain.

FERTILIZERS.

Professor Voelcker, in his report to the Chemical Committee of the Royal Agricultural Society of England, read December 2, 1868, says: "The experiments on artificial grasses, on the whole, are confirmatory of similar ones made in previous years. They bring out strongly the beneficial effects which a mixture of salts of potash and superphosphate produces on seeds grown on poor, light, sandy soils, and show the inefficacy of potash for seeds, and, I may add, for nearly all crops on land in a high state of cultivation, and on soils containing a fair proportion of clay."

Coal-ashes.—Recent experiments in respect to the use of coal-ashes as a fertilizer are apparently contradictory in their results. One cause of this is readily perceivable, viz., the great difference in the proportion of certain chemical elements which are observable in these ashes. Some varieties of coal-ashes for instance show a much larger percentage of oxide of iron than do others. English and French experiments refer to the use of bituminous coal-ashes. A Chinese yam *(Dioscorea batatas,)* planted in a bed of anthracite ashes, grew luxuriantly, and gave excellent results. The bed was twelve to eighteen inches deep, entirely separated from common earth by boarding under the bed.

Cancerine.—At a mill recently erected in Goshen, New Jersey, large

quantities of king-crabs, or horse-feet, are prepared for use as fertilizers. They are ground as finely as possible, put up in bags, and sold under the name of cancerine, at $25 per ton at the works, which manufacture 100 to 250 tons per annum. Another mill at West Creek, in the same State, produces about the same quantity. This fertilizing material is applied to wheat at the rate of 800 pounds per acre, which quantity the State geologist reports is fully equal in value to 400 pounds of guano, costing $18. Compared with guano at $60 per ton, cancerine is estimated to be worth, for use, about $39 50 per ton.

Marls.—During the year 1868, several new companies have been established in New Jersey for digging and transporting the marls for which that State is celebrated. It is thought that the trade in these valuable fertilizers will in 1869 be double what it was in 1867. The amount of marl used in the State is estimated at very near *one million tons.*

FORESTS AND TIMBER.

The following abstract is from a communication by the Hon. J. M. Edmonds, late Commissioner of the General Land Office, on the waste of forests, their preservation, &c. The paper appears in full in the monthly report of this Department for January, 1869: Except in the mountain regions, nearly the whole surface, from the Atlantic to the Mississippi, has been despoiled of its primeval growth. The absolute waste is less than formerly, but the waste and consumption are far greater than at any former period. No considerable effort has been made toward production. * * * Our people have now gone through and surrounded the great primeval timber reserve, and have already entered on the margin of the vast treeless plains and plateau, with three-fourths of the original store consumed, the demand accelerated, and the number of consumers rapidly rising from 38,000,000 to 50,000,000. Look forward fifty years—our forests will be exhausted, the demand for the products quadrupled, and the country and people be suffering for the protection which forests would afford.

Maine, Michigan, Wisconsin, Minnesota, and Florida are the only States east of the Mississippi which now export any appreciable quantity of timber more than they import, and the reserve in these States is being rapidly cut away. * * * The mountain and plateau region, occupying the interior of the continent, has only a moderate supply. * * * No supplies can be drawn from this region for the older States, or even for the great plains, without exhausting a reserve which is already below the immediate prospective demand. In the Pacific States and Territories there is still an adequate supply, but not beyond the early prospective wants of their own people. The States bordering the Mississippi on the west have no surplus, and most of them are at this moment importing to meet the demands of even their sparse population. * * * Arizona, New Mexico, Colorado, Wyoming, Montana, Idaho, and Dakota have but a meager supply, not sufficient for a population as dense as now occupies Ohio, Indiana, or Illinois. Only the newly acquired territory of Alaska remains to be considered. Very little is known of its timber resources, but, in much the largest portion, it is known that its rigorous climate precludes the growth of valuable forests, and it is not too much to presume that the timber in that Territory will be insufficient to meet the demands of the trade now opening with the great populations of China and Japan. Considering, then, the present and the prospective forest products in this country in the light of their

necessity for domestic purposes, and for the protection of men, animals, fruits, and grain, and of their value in inducing moisture, protecting the soil, and tempering the climate, it is, indeed, important that every section of the country should retain, if it has them, and if it does not have them, should immediately engage in their production, at least to the extent of supplying local use and protection.

Trees as rain producers.—In Upper Egypt the rains, which eighty years ago were abundant, have ceased since the Arabs cut down the trees along the valley of the Nile toward Lybia and Arabia. A contrary effect has been produced in Lower Egypt, from the extensive planting of trees by the Pasha. In Alexandria and Cairo, where rain was formerly a rarity, it has, since that period, become more frequent.

Professor R. C. Kedzie, of Michigan State Agricultural College, in an address on "The influence of forest trees on agriculture," delivered not long since before one of the county societies in that State, gave a very earnest warning against the wasteful destruction of forests, citing, at the same time, the well-known facts of current history. It is noticeable as a hopeful fact, that prominent agricultural societies, in various sections of the country, have recently been emphatically directing public attention to this matter.

Forestry in India.—In 1864 the British government founded an improved general system of forêst administration for the whole Indian empire, having in view the preservation and development of state forests. All superior government forests are reserved, and made inalienable, their boundaries marked, and forest rules and penalties defined. Surveys have been made, and are still in progress, toward establishing data as to the nature and extent of the timber resources. Several thousand mahogany trees have been raised in the Terai. Large tracts have been planted to wood for the purpose of supplying the railways, which consume immense quantities for fuel.

Lumber in Washington Territory.—Puget Sound, Washington Territory, is well known as a principal source of the lumber export of the North Pacific coast. Besides amounts consumed within our own territories, many cargoes of lumber are annually shipped from thence to ports in China, the Sandwich Islands, Australia, and South America. The following statement in regard to the resources of Puget Sound is on the authority of Mr. Joseph Cushman, receiver of public moneys at Olympia, situate at the head of the sound: "The time is not far distant when nearly all the ship-building on the Pacific coast will be done on the shores of Puget Sound. From the Cascade range to the Pacific, comprising about one-half of Washington Territory, the surface is densely covered with the finest forest growth in the world. Some of the trees, straight as an arrow, are four hundred feet in height, and fourteen feet in diameter near the ground. Varieties of the fir predominate, interspersed with spruce, hemlock, tamarack, white cedar, maple, ash, white oak, and, on some of the mountain slopes, white pine. The yellow fir *(Abies Douglasii)* is a tree peculiar to the North Pacific coast from the forty-second parallel to Alaska, and is found only east of the Cascade range, north of the boundary of forty-nine degrees. This is the timber principally used at the saw-mills on the Sound, and is both strong and durable; in fact it is the strongest timber on the coast, both in perpendicular pressure and horizontal strain. * * * The abundance of timber, coal, water-power, and iron ore in the vicinity of navigable waters, together with fine harbors, large saw-mills, temperate climate, and natural facilities for manufacturing cordage, all clearly indicate that the Puget Sound country will soon occupy a prominent position in ship-building. Experi-

ments made by the French authorities in the imperial dock-yard at Toulon are cited as showing that masts from Vancouver's Island, and, by similarity of circumstances, those from Puget Sound, are superior to the best class of Riga spars.

Lumber in California.—The report of the surveyor general of California for 1867 makes exhibit for that State of 220,991,213 feet of lumber sawed, and 108,007,000 shingles made, of which Mendocino sawed 50,000,000 feet of lumber and made 1,000,000 shingles. The report, however, is imperfect, on account of deficiencies in county returns.

Premiums for tree planting.—Among the premiums for 1868, offered by the Worcester North Agricultural Society, Massachusetts, are three: $25, $15, and $10, for the best plantations of any kind of forest trees, suitable for fuel or timber, raised from seed, not less than five hundred in number, which shall be in the most flourishing condition in the fall of 1868. The Plymouth County (Massachusetts) Agricultural Society offer two premiums, $40 and $20, for a similar purpose; the trees to be over three years old in September, 1872. The society also offer premiums for the planting and cultivation of ornamental trees on or near the highways and public squares of the county towns.

Profit of planting.—Mr. T. B. Coursey, writing on the propriety of growing timber, speaks of a man who bought a poor farm in Delaware, about twenty years ago, and concluded to plant pine-seed and chestnut on one side of his farm near the banks of a creek, where his land was gullied by heavy rains. The outlay did not amount to twenty dollars, and he now has hundreds of cords of wood, and abundance of logs from which to make boards for temporary uses.

The government of Greece is now spending about £3,570 annually for the preservation of forests, and derives from them an annual revenue of about £13,400.

FLORIDA ITEMS.

A committee of one of the Florida "Boards of Trade" remarks in respect to Duval county in that State: "Potatoes and cucumbers can be made ready for transportation by the first of May, and, with proper care, tomatoes can be easily made ready for shipment by the first of June, and thus placed in the northern markets before they can be furnished by the hot-beds of the farm gardeners of Virginia, Maryland, Delaware, New Jersey, Pennsylvania, or Long Island."

An abridged statement of the values of exports from the port of Jacksonville, Florida, from January 1, 1868, to June 30, 1868: Foreign exports, $23,949 87; of which amount $22,938 were in pitch-pine lumber, the remainder being chiefly in cypress shingles and spirits of turpentine. Coastwise exports, $669,724; in which are included cotton to the value of $416,492, pitch-pine lumber to the value of $165,465 78, vegetables, &c., $24,900, oranges $10,925.

ILLUSTRATIVE FACTS.

From a volume by T. F. Cronise, on the "Natural Wealth of California," published in San Francisco during the present year, the following statement is abstracted: The village of Anaheim, in Los Angeles County, California, situated on a level plain eight miles from the sea-coast, was originated by a company of Germans, acquainted with the culture of the grape in the "Fatherland." The site of the village was, in 1857, a barren, dry, sandy plain. In the summer of that year the foregoing

company purchased the land, amounting to 1,265 acres, at $2 per acre. This was divided into lots, which were fenced with willows, sycamores, and poplars. A large proportion of the area was planted with vines. A ditch, seven miles in length, was cut to bring water from the Santa Ana River. The land was cultivated for two years, at the expense of the company, by hired labor. At the end of that time the lots were distributed to the shareholders. After all the expenses were paid, each share of twenty acres fenced, partly planted in vines two years old, together with a building lot one hundred by two hundred feet, situated in the center of the village and appertaining to the share, cost $1,400. There are, at the present time, near 1,000,000 vines growing in the village, of which about 750,000 bear fruit. There are also 10,000 fruit trees of various kinds. The whole place resembles a forest and flower garden, divided into squares with fences of willow, poplar, and sycamore, which shelter the vines from every wind.

In striking contrast with the prosperity of Anaheim is exhibited the condition of the town of San Juan Capistrano, situated about thirty miles distant from the preceding village, on the main road between Los Angeles and San Diego. The valley in which the town of San Juan Capistrano is placed is about nine miles in length, and nearly a mile wide. The San Juan, a never-failing stream, passes through its entire length, furnishing an abundant supply of water. The soil is rich, but almost wholly uncultivated. The population of the town numbers about six hundred, of whom four hundred are Mexicans and native Californians, and about two hundred Indians. There are not more than half a dozen Americans or Europeans in the place, but these are generally thrifty and prosperous. This is the most thoroughly Mexican town in the State. * * The only apparent employment of the men is horse-racing or practicing with the reata. The women are rarely seen, except at the fandango or church. The children literally swarm in the streets, and are of all hues except that of the lily; they wear little or no clothing.

Until about 1833 the agriculture of North Germany was in a decidedly backward state. But since that time a very great advance has taken place. The amount of live stock has enormously increased, and the soil has grown more productive. M. de Laveleye, in an article in the *Revue des Deux Mondes*, speaking on these points, shows that, reducing the live stock to equivalents of horned cattle, in 1865 Prussia had 100 head for every 138 of the population; France, only 100 for every 185 of the population. Forty years ago, these proportions were reversed. M. de Laveleye states as the chief causes of this great advance, first, the complete extension of general education throughout the rural districts of Prussian Germany; second, the wide spread diffusion of technical agricultural instruction. Prussia maintains four Royal Agricultural Societies, and nineteen provincial schools of agriculture, subsidized by the state. There are also numerous special schools for instruction in particular branches, such as market-gardening, &c. The system of paid instruction is completed by the curious institution of itinerating teachers, who travel from village to village, criticising the cultivation, and giving advice about rotation of crops, and the most suitable kinds of manure. Institutions of organic and agricultural chemistry are also maintained by the state. There are, besides these, more than five hundred voluntary agricultural associations contributing to the general advancement by conferences, exhibitions, and prizes.

The actual territory of the Papal states includes an area of 4,247 English square miles. This area, now so impoverished by long ages of

desolation and wasteful exhaustion, was in ancient times especially celebrated for its mineral wealth and productive soil. The elaborate memoir of Signor David Silvagni, of Rome, presented at the sixth session of the International Statistical Congress, at Florence, shows that the industry of the country has made very little progress during the last half century. The woolen, cotton, and silk manufactures, remain in the same state as in 1826. Agriculture languishes. No improvement takes place in methods of cultivation. The exports are insignificant when compared with the imports. The latter are valued at 38,000,000 francs; the former at less than 9,000,000 francs. Says the memorialist: "Our only export of importance is that of objects of the fine arts, which increases yearly: but the fine arts have gained nothing by becoming a branch of trade. Roman art is reduced to a mean condition of mere mechanical labor, except in the case of a few distinguished artists." And he adds that this country, capable of being transformed into a garden, and which might be the richest in the world, would see its population die of hunger, were it not for the visits of multitudes of travelers, and for the pilgrimages of fervent Catholics who resort there to receive the benediction of the Pope.

The State geologist of New Jersey, in his report for 1868, after speaking of the considerable increase of population since 1860, taking the State as a whole, says: "It is a remarkable circumstance that, in the older settled counties, there is a rapid increase in taxable property and in the value of agricultural products, and not much increase in population. This is undoubtedly due to the improvements in management, to the use of fertilizers in larger quantity, and to the introduction of labor-saving implements. Farms without number can be shown which produce from two to four times as much as formerly, and on which there is no increase in the amount of labor employed."

A Sacramento paper states that in the counties of Santa Clara, Napa, and Solano, comprising the oldest wheat-raising districts of California, the average yield of this crop has declined from thirty-five bushels per acre, as in the early years of wheat culture, to eighteen bushels per acre, at the present time.

Mr. Latham, the English civil engineer, states that since the construction of sanitary works, as sewerage, &c., at Croydon, England, the average mortality of the town has decreased twenty-two per cent.; and exhibits figures as proving that the town has, in the space of thirteen years, received, in consequence of the construction, a pecuniary benefit amounting to an excess of twenty-five per cent. over the total expenditure incurred upon the works.

MISCELLANEOUS.

On one of the islands within the limits of St. Mary's Parish, Louisiana, Petit Anse or Salt Island, there exists an immense bed of salt. By boring, parties have proved that the bed is half a mile square, and it may extend a mile or more. They have gone thirty-eight feet into the solid salt, and find no signs of the bottom of the stratum. The surface of the salt is on a level with the surface of the Gulf water, and is covered by earth to the depth of thirty feet.

The president of the Oregon State Agricultural Society, in his address before the society in September, 1868, says, speaking with special reference to wheat culture, that during the careful observation of almost ten years' residence, "not in one instance have I known a failure in any crops in Oregon where the crop has been well prepared, judiciously

planted or sown, and properly cared for. And in many instances I have seen fields of wheat in Oregon that, for quality and quantity, far surpassed any crops I ever knew raised in Northern Wisconsin or on the fertile fields of the Genesee Valley. Oregon is pre-eminently a grain-growing State, and for the sure production of wheat is not surpassed by any country inhabited by civilized man."

San Francisco receipts and exports of the articles named for the year ending December 31, 1868, were as follows:

	Receipts.	Exports.
Wheat, 100-pound sacks	5,728,852	4,099,115
Flour, bbls	308,276	461,868
Barley, 100-pound sacks	657,887	78,422
Oats, 100-pound sacks	232,285	6,479

In the year ending July 1, 1863, the exports of wheat and flour were: flour, 144,883 barrels; wheat, 1,043,652 sacks.

The report of J. Ross Browne on the mineral resources of States and Territories west of the Rocky Mountains, says that "Camus, as an article of food for the Indians, is probably the most important of all the wild plants, and is abundant in all the northern parts of the Pacific coast. It is a bulbous root, about an inch and a half in diameter, and grows in low, swampy lands, having a sweet, gummy taste, and is very nutritious. Besides using it largely when fresh, the Indians boil and afterward dry it, so as to preserve it for years. If cultivated, it might become a valuable culinary vegetable." The plant is otherwise known as the eastern quamash, or wild hyacinth, and in botanical nomenclature is *Scilla Fraseri*.

In England, as well as in this country, the adulteration of seeds, especially the mixing of old with new, is carried on to a very great and injurious extent. In France any one guilty of the adulteration of agricultural seeds is liable to punishment as a criminal.

In respect to the effects of stormy autumn weather on cattle fattening for market, Mr. McCombie, the celebrated Aberdeenshire cattle-feeder, states that he has found a difference of £5 per head between cattle put up on the first of September and others put up exactly a month later, although the animals originally formed one lot equal in all respects, and those left out were kept "on fine land and beautiful grass."

An ox slaughtered near London weighed, when alive, 2,588 pounds; slaughtered and dressed, 1,963 pounds. As it was sold at one shilling per pound, the amount realized was about $490. The ox was bred by Mr. McCombie.

In India, the use of American cotton-seed for planting is gaining increased favor. The Bombay authorities report that the New Orleans variety is much more productive than the India cotton.

The secretary of the Michigan State Board of Agriculture, in referring to the great damage done by the midge to the wheat crop of 1867 in that State, indicates the probability that millions of dollars might have been saved to the farmers had the Treadwell and the Diehl variety of wheat been sown instead of the Soule.

The number of mulberry trees in California, in 1868, is unofficially estimated at about 1,175,000, of which 425,000 are allotted to Sacramento County. There appears to have been a very rapid increase of the number of trees in the State since the previous year, only 356,053 having then been reported by the assessors for the entire State. The sale of silk-worm eggs promises to become a large business for California.

The "Canada Farmer" mentions a horse owned by M. Yoder, of Springfield, Ontario, which is believed to be over thirty years old, and is still fat, plump, and handsome. The same journal suggests that prizes should be given at agricultural fairs for the best old horses, as only a good, kind horseman can show an active old horse.

It has until recently been a generally accepted doctrine among entomologists, that the females of the *Cicada septemdecim* never deposit their eggs in evergreens. But R. H. Warder has recently proved by actual exhibition that they do deposit in three of our most common evergreens, *Thuja occidentalis*, *Juniperus Virginiana*, and *Abies Canadensis*.

In Hudson County, New Jersey, a rent of $100 per acre has been paid for land for market gardening.

The subjoined table indicates the variations in the value of hops, in New York, during a course of nine years. First, is presented the currency value of gold in January of each year from 1861 to 1869 inclusive; second, the wholesale currency price of hops per pound; third, the wholesale price converted into gold rates:

New York.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.
American gold	Par.	Par.	133⅓	152	227	144½	133	133½	135¼
Hops per pound, currency, cents	25	20	23	33	50	60	60	60	20
Hops per pound, gold rates, cents	25	20	17	22	22	42	45	45	15

Mr. J. J. Mechi, the English agriculturist, keeps three hundred head of poultry, which have free access to the fields near the homestead. He says: "Poultry are the farmers' best friends, consuming no end of insects, and utilizing and economizing all waste grain. It costs no more to produce one pound of poultry than one pound of beef."

Mr. George Manning, in his statements before the food committee of the Society of Arts (England,) gave the following, among other reasons, accounting for the frequent failures to make poultry-keeping profitable: want of attention to choice and management of stock, irregular and wasteful administration of food, want of attention to the roosting, and particularly to the laying-place of hens. He also remarks: "Our system of leaving chickens to shift for themselves until such time as they are ready or wanted for the coop is all wrong. No attempt at after-fattening will increase the frame, if the feeding of infancy has been neglected." Chickens and weaker birds should not be suffered to starve while the powerful are gorged.

THE PUBLIC DOMAIN.

The public domain of the United States has embraced an area amounting in the aggregate to 1,446,716,072 acres, exclusive of the recent purchases from Russia, estimated to contain 369,529,600 acres. The lands constituting this domain were acquired by treaties with foreign powers and by grants from several of the original thirteen States. Out of this vast estate, from time to time, powerful States and flourishing Territories have been created.

In some of the acquired territories large private claims have been confirmed to parties holding under other governments at the time of cession; the aggregate amount of such claims segregated from the public domain, down to June 30, 1868, being 16,943,458.51 acres. Up to the same date, 165,001,359 acres have been disposed of to purchasers and homestead settlers; 60,627,142.03 acres have been granted for military services; 6,306,475.91 to found agricultural colleges; 38,515,065.32 to promote the construction of wagon roads and railroads, and for other internal improvements; 69,066,802 to aid schools and universities; 47,423,950.62 approved to States as swamp lands; 13,280,699.94 reserved for the benefit of Indians; and 12,466,767.23 acres for all other purposes, including lands located by Indian and other scrip, salines, for government buildings, grants and reservations for individuals and corporations.

Notwithstanding these munificent donations, and the giving away and disposal at merely nominal rates of so great an area to actual settlers, there remained, on the 30th of June, 1868, 1,465,366,678 acres, equal to eighteen times the area of Great Britain and Ireland, or the whole of Russia in Europe and Germany proper. Of the 1,834,998,400 acres acquired by the government at different times, and known as the public domain, there have been surveyed a total of 496,884,754 acres, leaving unsurveyed 1,338,113,646 acres. Of surveyed lands still belonging to the government and subject to pre-emption and homestead entry, there is an aggregate of 67,253,032 acres. The disposal of public lands by cash sales, pre-emption, homestead entries, location of military warrants, college scrip, selections in aid of the reclamation of inundated lands, &c., for the fiscal year ending June 30, 1868, amounted to 6,653,742 acres, of which more than 2,500,000 acres were taken up under the pre-emption and homestead laws; that is, by *bona fide* settlers, who have thus opened up within one year more than 20,000 new and productive farms. Of the quantity entered as stated, 526,077 acres were taken in the southern States under the homestead act of June 21, 1866, and the residue in the Mississippi Valley and the States and Territories of the Pacific slope. In Ohio, Indiana, and Illinois there are only a few isolated tracts undisposed of. In the States of Arkansas, Alabama, Louisiana, Mississippi, and Florida, under the act of Congress approved June 21, 1866, no public lands can be entered except for actual settlement and cultivation as homesteads.

Surveyed lands in considerable quantities may still be had in Michigan, Missouri, Wisconsin, Iowa, Kansas, Nebraska, Minnesota, California, Oregon, and Washington Territory. The first public sale of lands in Colorado was made in September of the current year by proclamation

of the President, about one hundred townships being thus brought into market. In the Territories of New Mexico, Dakota, Idaho, Montana, Arizona, and Utah, district offices have been organized and surveys are being prosecuted, but no government lands in any of them have been offered at public sale. Settlements have thus far been made under the provisions of the pre-emption and homestead acts.

It is doubtless true that fields as rich and inviting as any the government has disposed of still await the settler, literally without price. Millions of acres heretofore little in demand on account of remoteness from market centers, are being made valuable and desirable by proximity to lines of railway. The Pacific railways, complete and projected, promise a rapid development of our more distant territory, and the creation of a demand for the public lands, which will, within a few years, absorb the most desirable for agricultural and herding purposes. The time to secure the best lands is obviously now.

That great enterprise of the age, the Pacific railroad, connecting the two oceans, was completed in May of the present year, and traverses three of the public land States and three Territories—Nebraska, Nevada and California, Wyoming, Montana and Utah. The eastern division of the road, starting from Kansas City, in Missouri, is fast approaching Denver, passing through the center of Kansas, and to the heart of Colorado. A deflection of this road in a southwesterly direction to the Pacific is proposed, which will pass through southeastern Colorado, and span the richest portions of New Mexico, Arizona, and southern California. A company has been incorporated for the purpose of constructing a Northern Pacific railroad, which, starting from the head of Lake Superior, is designed to pass through Minnesota, Dakota, Idaho, and Washington, and terminate at a point on Puget's Sound, in Oregon. It is claimed by the projectors of this route that it possesses very important advantages over routes further south; that it is the shortest and most central line, crossing the continent at a point where the waters of the great lakes approach nearest the Pacific; that it is the best practicable route, the mountain ranges being here most depressed. It is furthermore stated that there are no deserts along this line, which traverses everywhere tracts of great agricultural and mineral wealth. The climate of this region is of a mildness far beyond what might be expected in such a latitude, as is shown in the great northern deflection of isothermals. It is claimed that the local business of this route will support each successive section as it is placed in running order. With all these advantages, the statement of which does not seem to be controverted, it has been found hitherto impracticable to enlist the capital essential to its prosecution. In this exigency Congress has been asked for a loan of its credit on terms similar to those accorded to the Union Pacific railroad. We may reasonably expect that the rapid development of the industrial and commercial value of the routes contemplated by the Northern Pacific railway, and the Union Pacific, eastern division, will cause their construction in any event.

The public domain extends over twenty-three degrees of latitude and forty-five degrees of longitude, comprising large tracts of arable land, and embracing every variety of soil and climate afforded by the continent. The stock-raiser, the dairyman, the grower of cereals or of fruits, and the gardener may choose in these proffered fields a climate and soil adapted to the most successful prosecution of their respective husbandries.

The following brief references to States and Territories in which the largest amounts of public lands are situated may be of service to those

who contemplate taking up lands under the homestead or pre-emption laws. Our purpose being to speak particularly of the agricultural and pastoral advantages of the respective public land States and Territories, no especial note is made of mineral resources. For much valuable information on these subjects we are indebted to late reports of the Commissioner of the General Land Office.

MISSOURI.

There are remaining unsold in this State about one million and a half acres of public lands. These are located for the most part in the western and southwestern parts of the State—the larger portion in the latter. In a State so long settled as Missouri has been, and, by reason of its climate, soil and great mineral wealth, holding out the highest inducements for occupancy, it is not surprising that the choice and most desirable of the public lands have been taken up. Nevertheless, in the large tracts still undisposed of, very good farming lands may be found. The new system of labor which has obtained in the State since the close of the war of the rebellion has tended to develop its great natural resources, and induce a large immigration to its open fields. During the fiscal year ending June 30, 1868, as shown by the Report of the Commissioner of the General Land Office, over 300,000 acres were located under the different acts of Congress. The warm and genial climate of Missouri is adapted to the cultivation of the fruits, corn, tobacco, and hemp. In the production of the latter staple the State has yielded only to Kentucky among the States of the Union. Missouri is well watered, and affords a great diversity of surface—mountain, valley, prairie, forest and low-land. Nearly every part of the State furnishes excellent water-powers. Coal is abundant, the State Board of Geological Survey estimating the workable coal area at 26,887 square miles, exclusive of outlying and local deposits—equal to an annual supply of 1,000,000 tons for at least thirteen hundred years to come.

WISCONSIN.

The principal part of the unsold government lands in Wisconsin are situated in the northern portion of the State, and are more especially important on account of their timber, which has become a valuable element of public wealth. In the land districts of Eau Claire and Bayfield, however, good agricultural lands may be entered. A large portion of the soil in the region of the unsold lands is not generally adapted to the purposes of agriculture, being wet and marshy, or a dry drift sand. Some localities around the margins of lakes or along the hill-sides are well suited to stock-raising. Good government lands may be found in the vicinity of some of the smaller lakes, of which there may be said to be hundreds in the State, varying from one acre to several square miles in extent. These lakes frequently form chains linked together by inlets, and abound in a variety of fish. The climate of the northern portion of the State is cold, yet equable, the average temperature on the Lake Michigan shore being 6½° Fahrenheit higher than on the Mississippi River. The number of acres undisposed of in Wisconsin is 9,258,627.

MICHIGAN.

The State of Michigan is divided into two peninsulas by the Straits

of Mackinaw, which unite Lakes Michigan and Huron. The northern peninsula presents a rugged surface; the climate is rigorous, and the soil, for the most part, not adapted to the purposes of agriculture. The central portion of this peninsula is rolling table land, well timbered. The southern peninsula is remarkable for its fertility. The surface is generally level and elevated, rising gradually from the lakes to a plain in the interior, which is well wooded. The climate of southern Michigan is milder than the same parallel in the eastern States. That part of the southern peninsula known as the "Grand Traverse Country" is attracting the attention of actual settlers and parties speculating in lands. In this district the Michigan State Agricultural College has located over 100,000 acres. The climate and soil are favorable to the growing of peaches, pears, grapes, and other fruits. Wheat of the best quality, comparing favorably with any raised in other parts of the State, is successfully cultivated. Its sheep-walks are highly spoken of. The secretary of the State Board of Agriculture says concerning the timber of this region: "The prevailing growth over a large portion of the country, embracing the best soil for cultivation, is the sugar maple. Having considerable acquaintance with this species of tree, from the Penobscot to the Potomac and Ohio, the writer can safely say that he never saw such grand specimens as are to be met with in countless numbers in the Grand Traverse Country. They are frequently found of a height of sixty to seventy feet, without a limb, of a diameter of three feet or more at the ground, and very straight. Of course, such large trees cannot stand as closely together as smaller ones; they hold possession of the ground, however, which is in many cases free from undergrowth, so that the forest presents the appearance of an artificial plantation or park, through which people on horseback may readily pass in any direction." Of government lands undisposed of in the State there are 4,614,068 acres.

MINNESOTA.

In this flourishing State 35,534,000 acres are open to settlement, of which 13,510,575 acres have been surveyed. The surface of the State is diversified by undulating prairie, belts of timber, "oak openings," lakes in great number, and numerous streams. In the northern and western parts of the State what are known as the Highlands constitute an exception to the general evenness of surface. This district, 16.000 square miles in extent, occupies an elevation of about 450 feet above the general level of the country, and is covered with a dense forest growth, for which it is chiefly valuable. Red River Valley, covering an area of 18,000 square miles, with its rich alluvial soil, produces immense grain crops. This district is sparsely timbered, and has few lakes or streams. The Mississippi Valley, embraced within the limits of the State, is nowhere surpassed in fertility. A rolling prairie predominates, which is well drained by the lakes and streams that form a network in this favored region. Groves and belts of timber are numerous. Minnesota is justly celebrated for a superior quality and abundant yield of wheat. On account of its high latitude the winters are somewhat severe, but less changeable in temperature than the lower latitudes. Superior advantages are claimed for Minnesota as a stock-growing State. Nearly the entire upper half, and a considerable portion of the southwestern section of the State have not yet been surveyed by the government. Within the State there are 35,534,000 acres of public lands subject to pre-emption and homestead entry.

IOWA.

The bulk of the public lands in Iowa, still subject to sale and homestead entry, are located in what is known as the Sioux City land district, embracing the counties of Sioux, Lyon, Osceola, O'Brien, Cherokee, Ida, Sac, Buena Vista, Clay, Dickenson, Woodbury, Plymouth, and the western parts of Emmet, Palo Alto, Pocahontas, and Calhoun. In most of these, public lands are to be had, amounting, in the aggregate, to over 1,500,000 acres. This section of the State is supplied abundantly with running streams, many of which furnish admirable water-powers. In several of the counties named there are beautiful lakes, varying in size and depth—Spirit Lake, in Dickenson County, being the largest. Springs are common, and in their absence pure water may be obtained at almost any point by sinking wells ten to twenty feet in depth. The surface is undulating prairie, generally well drained. Hon. A. R. Fulton, a member of the legislature of Iowa, who recently made a personal inspection of the lands of this district, says the upland prairies are more rolling than the valleys, and have in some places the appearance of waves or billows of the sea, especially in the summer season, when their green covering of grass is touched by the gentle winds that pass over them. The soil is somewhat different from that in the valleys, but is rich, and well adapted to the raising of wheat. The valley land is nearly all above high-water mark, and, although apparently nearly level, is dry, and susceptible of easy cultivation. The soil is a deep loam, with an admixture of sand, which has the effect of making it retentive of moisture, while it seldom remains for any length of time so wet as to prevent farming operations. The Missouri River bottom is from ten to twenty miles wide; the valleys of the Big Sioux, Little Sioux, Floyd River, and their several tributaries, vary from a half to two miles in width. The bottom lands are especially adapted to corn and vegetables, while wheat, oats, and rye will flourish alike on both the upland and bottom prairies. Timber is found in greater or less abundance on the margins of streams. The climate of this portion of Iowa is conceded to be healthful; the atmosphere, while it is somewhat severe in winter, with high winds, being clear, pure, and dry.

The rapid development of the railroad system in the State, crossing over the public lands, is opening up increasingly large tracts to settlement. In no other State are lands being taken up more rapidly. The Iowa Falls and Sioux City railroad, whose route traverses from east to west valuable portions of the public area within the Sioux City and Fort Dodge districts, will be completed, it is believed, before the beginning of the year 1871. The St. Paul and Pacific railroad, to which a munificent grant of lands was given by Congress, is now in process of construction, and will connect, when completed, the northwestern counties of Iowa with the lumber regions of Minnesota.

KANSAS.

Over forty-two and a half million acres of land are subject to sale and entry in this young and growing State. The general surface is prairie, with a soil from two to three feet in depth, resting on a fortifying sub-soil. There are no mountain ranges or lakes and but few swamps in the State. Water-courses are abundant, most of the streams having a gentle current, and flowing over rocky or gravelly beds, with high banks. The Neosho River Valley is considered the garden spot of Kansas. The southern portion of the State, including the Osage purchase, is well

adapted to grazing. The climate is temperate and healthful, and especially favorable to stock-raising. In the southern part of the State the temperature is so mild that little provision for the wintering of cattle is necessary. All kinds of grain and vegetables common to its latitude are grown successfully. Fruit-growing has not been tested to any considerable extent, but nurserymen express the belief that fruit will do well. The climate is peculiarly adapted to the cultivation of the grape. Excellent wine from the Kansas grape has been manufactured. The various kinds of small berries grow in great profusion.

The population of Kansas, which in 1860 was 107,206, is now estimated at over 440,000, and the State is filling up with great rapidity. In the year 1867 nearly 2,900,000 acres were surveyed in the Cherokee neutral and Osage reservations, situated near the southern boundary of Kansas. As Indian reserves, these lands had been kept out of the market, and are reported as among the most desirable in the State. They are now open for homestead entry. It is estimated that there are nearly ten million acres of alluvial lands in the State undisposed of.

NEBRASKA.

The surface is gently rolling, gradually rising toward the west, and is almost entirely free from low marshes. The river valleys are rich and productive; vast prairies extend in all directions, with a diversity of soil, from the best alluvial and good upland to the gravelly ridges and barren sand-hills. There is no scarcity of water. Timber is somewhat scarce in localities, but numerous groves of cottonwood, oak, walnut, &c., grow along the rivers. The climate is mild, and the summers are of a high temperature. Stock is easily subsisted and provided for on the prairies, where a rich native grass grows in great abundance. The State is traversed from east to west by that great national highway the Union Pacific railroad. There are yet of public lands undisposed of in the State 41,624,000 acres. The fertile lands in the valleys of the Republican, Nebraska, and Platte are being taken up rapidly by actual settlers.

COLORADO.

In his report of July, 1868, to the General Land Office, the surveyor general of Colorado says that Territory has some of the finest pastoral and agricultural lands in the world, and fine food for cattle. Already large herds of cattle and horses are raised on its rich mountain and valley pastures, and in a few years stock-raising will be of immense value to the country. The lands susceptible of irrigation produce wheat finely, the product reaching forty to sixty bushels per acre. The valleys, or distinctly agricultural regions of Colorado, embrace 30,000,000 acres, one-sixth of which admits of cultivation, the remainder being admirably adapted to purposes of herding. On account of the scarcity of rains, irrigation is necessary, and lands are selected with reference to the ease with which irrigation may be accomplished, farmers uniting in constructing irrigating canals at comparatively small cost. On these lands, formerly considered valueless, wheat has yielded eighty bushels to the acre, oats a hundred bushels, corn over a hundred and fifty bushels in the ear, potatoes five hundred bushels, while cabbages have been grown weighing thirty pounds, and turnips weighing fifteen pounds. Onions are a very successful crop. Plums, cherries, grapes, raspberries, and other small fruits grow profusely in a wild state. Some of the parks, or basins, protected on all sides by mountains, afford

an excellent soil and salubrious climate. San Luis Park, with an area of eighteen thousand square miles, is watered by thirty-five streams, and contains a population of twenty-five thousand, principally engaged in agriculture and stock-raising. Timber is scanty on the plains, but may be obtained in the mountains in the greatest abundance. Inexhaustible beds of coal have been found, and the Territory furnishes alum, salt, gypsum, soda, lime, lead, copper, antimony, zinc, silver, and gold.

DAKOTA.

The eastern portion of Dakota is well adapted to agricultural pursuits and wool-growing, affording a large area of natural meadow land and pastures well watered. Much arable land is found also in the north western part of the Territory. Settlers are locating along the Red River of the North, and in the valley of the Missouri River between Fort Randall and Fort Sully. The surface is generally elevated and well watered by large rivers and their affluents. The excellent land of this Territory and its valuable mineral resources give promise of rapid settlement. Nearly 91,000,000 acres are subject to pre-emption and homestead entry.

NEW MEXICO.

The lands in New Mexico susceptible of cultivation are confined exclusively to the valleys of streams. The Rio Grande, the Gila, and the Colorado afford facilities for a system of extensive and efficacious irrigation. "Properly so called," says Surveyor General Clark, "there are neither barren nor desert lands to any great extent in New Mexico. The Territory is properly divided between valleys, which can be irrigated by the streams flowing through them, mesas or table lands, (under which designation I would class all the lands not mountain or irrigable valleys,) and mountains." He estimates the arable lands of the Santa Fé district at 1,000,000 acres; the term arable being used as synonymous with irrigable, as no lands can be cultivated with any certainty of raising a crop without irrigation. There is a considerable rain-fall during the months of July and August, but so little during April, May, and June that, without irrigation, crops will ordinarily perish.

It is further stated by the surveyor general that the amount of irrigable lands is only limited by the amount of water in the streams; even the Rio Grande might all be used in the irrigation of the lands in its valley. The water supplied by irrigation not only affords the necessary moisture for the growth of vegetation, but also enriches the soil by depositing the sedimentary matter held in solution, and thus lands which have been under cultivation for more than two hundred years still produce excellent crops without ever having been manured or fertilized by other means.

The table lands and mountain sides produce the most nutritious grasses which afford excellent grazing throughout the entire year. No flies or mosquitoes annoy the herds, and disease among sheep and cattle is comparatively unknown. Peaches, apples, apricots, grapes, and, in the more southern portions of the Territory, quinces, pomegranates, and figs, grow abundantly.

ARIZONA.

The soil of Arizona and its general surface are not dissimilar in general characteristics to those of New Mexico, of which political divi

sion it at one time was a part. The acreage susceptible of irrigation is estimated at 5,000,000; the grazing lands at 55,000,000. The residue, 12,906,304 acres, is covered by water, or consists of plains not irrigable, and mountains. Evidences of a very old civilization exist in New Mexico and Arizona, among them ruins of cities and temples, and appliances for cultivating the soil. Traces of irrigating canals are discernible in many sections. Cattle, sheep, and horses may be pastured on plain and mountain during the whole year. The country is well adapted to the culture of wine and silk.

The survey of the Territory has been undertaken by the government. However, parties who may have settled in good faith upon the unoccupied lands will, when the lines of the public surveys are extended over their claims, be protected in their pre-emption or homestead rights.

CALIFORNIA.

It is estimated that there are not less than 80,000,000 acres of land in California suited to some kind of husbandry. Of this amount over 40,000,000 are tillable, and the remainder adapted to stock-raising, fruit-growing, &c. The southern portion of the State is more particularly devoted to horticulture. It is said that no better soil and climate are afforded in any country for the cultivation of the grape than in this part of California. The yield exceeds that of the most celebrated European vineyards. Three hundred varieties have been introduced. The acreage in vines is about 45,000, with an average of nine hundred vines to the acre. The vintage of 1867 was estimated at over 4,000,000 gallons of wine and about the same quantity of brandy. One thousand pounds of grapes to the acre is the minimum yield, while as high as 20,000 pounds have been produced. The orange, lemon, fig, lime, olive, apricot, nectarine, pine-apple, pomegranate, and other tropical and sub-tropical fruits grow in great abundance. Fruit trees grow more rapidly and produce larger varieties than in almost any other part of the world. The pear thrives in all parts of the State. In the markets of San Francisco strawberries are sold every month in the year.

The cereals, potatoes, tobacco, sorghum, and in some localities cotton and the sugar cane, are successfully and very profitably grown. Sixty bushels of wheat to the acre is not an unusual yield. The cultivation of the mulberry tree and the rearing of silk-worms promise to become an important source of wealth in the State. The worms seem to be exempt from the diseases which for twenty years have prevailed in many of the cocooneries of Europe, threatening the destruction of the native species. The California silk-worm eggs are in great request among European breeders. The State has undertaken to foster this important branch of industry by offering liberal premiums for the planting of mulberry trees and the production of cocoons. Silk factories are being erected in the State.

Stock and sheep-raising is a leading branch of husbandry. The mild winters and perpetual pastures enable stock to graze throughout the year. In the year 1867 there were 2,000,000 sheep in the State, yielding a wool product of 9,000,000 pounds.

California has an abundance and great variety of timber. The red wood, found only here and in the southern part of Oregon, is a valued commercial wood. It grows in dense forests, which are estimated to cover in the aggregate 10,000 square miles. The trees frequently reach a height of two hundred and seventy feet and a diameter of eighteen to twenty feet.

Good public lands in ample quantity are subject to purchase and homestead entry in almost any quarter of the State.

OREGON.

A large portion of the Willamette Valley is well adapted to agriculture. This beautiful and highly fertile valley, lying upon both sides of the river of its name, contains an area of 2,000,000 acres. The botton lands produce an almost unbroken line of forests, varying from one-eighth to half a mile in width, consisting of fir, oak, maple, cottonwood, and alder. The prairie lands possess a deep, rich soil. All the productions common to the field, garden, and orchard of temperate regions are here successfully grown.

The majority of the valleys afford rich and easily cultivable lands, among which may be named the Umpqua and the Rogue's River on the west of the Cascade range. The rich agricultural valleys of northern and eastern Oregon are attracting the attention of settlers. By many the climate east of the Cascade Mountains is preferred to that of the Willamette Valley. This portion of the State is as yet sparsely settled, notwithstanding its conceded advantages as an agricultural and pastoral region.

Northern Oregon, east of the Cascades, includes the attractive valleys of the Umatilla, John Day, Falls, Deschutes, and Crooked Rivers. What is known as East Oregon, east of the Blue Mountains, includes the valleys of the Grande Ronde, Powder River, Harney's Lake, Alvord, Owyhee, &c. Good farming and grazing lands, abundant timber and water may be found in these valleys. Settlements in several of them are just beginning to be made. The producing interests of the State are greatly on the increase.

WASHINGTON TERRITORY.

A large portion of the Territory is mountainous, but there are vast prairies and good grazing lands adapted to herding on a large scale. The Territory is divided into two sections by the Cascade Mountains, known as Eastern and Western Washington. In the former, a region embracing an area of 40,000 square miles, agriculture cannot be followed with success, except at rare intervals, on account of the scanty rain-fall and the difficulties in the way of irrigation. To use the language of the surveyor general of the Territory: "Notwithstanding present appearances and obvious difficulties, it is impossible for any one who has traveled over this vast and magnificent region, rich in soil and possessed of a most salubrious climate, to believe that the greater portion of it was destined to remain forever uninhabited, a vast and unreclaimable wilderness in the midst of population, wealth, civilization, and material progress." Exception must be made, however, in favor of the Walla-Walla district, where stock raising and the culture of wheat have been carried on with great success.

West of the Cascade Mountains there are immense tracts of arable lands inviting settlement. The valleys of the Chehalis and the Willopah contain the best lands of this section of the Territory, and are rapidly being filled up by a thrifty population. The valley of Puget Sound, with an area of 12,000 square miles, affords rich farming lands along the numerous water courses. Quoting again from the surveyor general: "Western Washington points to commerce, manufactures, and mines as the main sources of her present prosperity and future greatness: while

these industries, stimulated as they must be in the future, will consume the products of additional thousands of farms, giving the producers home markets and remunerative prices." The seasons of Western Washington are really only two, wet and dry, influenced by the semi-annual monsoons. From November to May the southwest winds prevail, bringing heavy showers, from May to November the cool and dry northwest winds give slight rain-falls and a moderate temperature. The winters are never severe; only on one occasion during the last twelve years snow fell to the depth of two feet.

The population of the Territory does not much exceed twenty thousand.

NEVADA.

The arable lands of Nevada, of which there are considerable quantities not taken up, are principally in the river valleys, some of which are very extensive and extremely fertile. The valleys of the Humboldt, Carson, and Walker rivers contain in the aggregate about three-quarters of a million acres of good tillable land. This amount may be largely increased by irrigation, for which ample and convenient facilities exist. Like the mountain country in several others of the States and Territories, Nevada contains large grazing tracts on the hills and mountain sides. The chief crops are grain, hay, and vegetables. Springs are numerous and water is abundant in all parts of the State. The climate is mild in summer, cold, but not severe in winter, the atmosphere being dry and salubrious. The route of the Pacific railroad traverses the valley of the Humboldt for more than two hundred miles.

It is not probable that an opportunity will long exist of taking up the best agricultural and grazing lands which may be now had in this prosperous and wealthy State.

IDAHO.

The surface of the Territory consists of mountain and table land, and river valleys of great producing capacity. In the sheltered valleys, which are numerous, the climate is mild and affords sustenance and protection for cattle and sheep at all seasons. The greater number of these valleys are still unoccupied except by inconsiderable settlements.

The Territory is well watered. Good water-powers are numerous. In the vicinity of the arable lands timber is scarce. Large tracts are susceptible of irrigation by means of canals and ditches, and under such circumstances produce the finest crops belonging to that latitude.

The present population is over 25,000, generally distributed in the neighborhoods of the more promising mining districts.

MONTANA.

The cultivable lands of Montana, like the other portions of the mountain country, consist of table lands, mountain slopes, and rich alluvial bottom or river valleys. The table lands, which are very extensive, require irrigation in order to realize their utmost production, and water for this purpose is convenient and plentiful. Wheat, rye, oats, barley, &c., yield abundantly. Cattle and sheep can be kept nearly all winter without other feed than they can obtain from the natural pasturage.

The surveyor general of the Territory estimates that fully one-third of the territorial area is susceptible of cultivation, 5,760,000 of which

are valley lands. He refers to the fact that the Jesuits, in commencing to cultivate the soil in the Bitter Root Valley, about twenty-five years ago, could raise scarcely anything; but continued experiment developed the proper course to be pursued, and the grounds in that region, which at one time refused to yield, are now prolific with splendid crops, the incoming settlers having profited by the experience of their predecessors. The yield of wheat throughout the Territory is up to the average per acre of any other State or Territory.

Timber is abundant on the mountains. Wood sufficient for fencing purposes and for fuel may be obtained on much of the tillable lands. Granite, limestone, slate, and fire-clay exist in abundance Brown coal, or lignite, is found in great quantity on the banks of the Missouri and Yellowstone Rivers.

WYOMING.

This Territory is a rectangular tract recently detached from the Territory of Dakota. It extends from the forty-first to the forty-fifth degree of latitude north and south, and from the twenty-seventh to the thirty-third meridian of longitude east and west, with a sort of pan-handle projecting from its northwest corner and extending along the mountain ranges almost to the thirty-sixth degree of longitude.

The public surveys have not been commenced in the Territory, and reliable information in regard to the character of its public lands is limited. The general features of the Territory will doubtless be found to correspond in the main with those of Montana and Colorado.

UTAH.

The Territory of Utah was not created a land district until July 16, 1868, and no public lands therefore have been sold. The surveyed lands, however, amount to something over two millions and a half acres, and surveying operations have been resumed, including the regions where actual settlements have been made.

The completion of the Union Pacific railroad, which passes through the Territory, has given an unwonted impetus to settlement here as in the other new States and Territories which it traverses. Utah, then a much larger political division than at present, was first settled in the year 1847 by the Mormons, who have demonstrated that agriculture can be made in that region a very remunerative pursuit, and that the parched mountain valleys may be made by artificial means to "blossom as the rose." By means of irrigating canals, the cereals, especially wheat, oats, and barley, yield from fifty to sixty bushels per acre; wheat has produced even as high as ninety bushels to the acre, and a case is given where, in the vicinity of Great Salt Lake, three and a half acres of land produced a hundred and eighty bushels of wheat from a single bushel of seed. In the southwestern valleys of the Territory, cotton, sorghum, and corn are raised with success. Garden vegetables and a great variety of large and small fruits yield abundantly. The settlements for the most part are along the Wasatch Mountains, on the western slope, from the northern to the southern limits of the Territory, wherever water is easily obtainable for purposes of irrigation along the alluvial belt, which varies in width from one mile to ten.

Large quantities of cotton are raised on the Rio Virgen and Colorado, and grazing and wool-growing are successfully carried on along the headwaters of the Green River. There are cotton, woolen, grist, and

saw mills in the Territory. It is stated that experiments in raising flax, and the mulberry tree, and in rearing the silk-worm, have been successful.

The Commissioner of the General Land Office, in his report for 1868, says that valuable tracts, either for grazing or farming purposes, remain unoccupied, and calls attention to the advantages of settlement here: "Aside from centrality of position, may be mentioned the existence of flouring mills, manufacturing establishments, shops, stores, and markets in every important locality, with supplies of horses, mules, and improved breeds of cattle, sheep, and hogs, thus furnishing to immigrants many facilities not found in less populous sections."

The population of the Territory is estimated at 120,000.

HOMESTEADS UNDER ACT OF CONGRESS.

By act of Congress, approved June 21, 1866, the public lands lying in the States of Alabama, Mississippi, Louisiana, Arkansas, and Florida, are open only to settlement as homesteads according to provisions of former enactments relating thereto; with the restriction, however, that until the expiration of two years from and after the passage of the act no entry should be made for more than a half-quarter of a section, or eighty acres. The object in the main, perhaps, was to encourage the freedmen to occupy these vacant lands. During the fiscal year ending June 30, 1868, 526,077 acres were taken up under the provisions of the act, and in the year preceding an aggregate of 264,480 acres. There yet remain undisposed of in those States 6,790,996 acres in Alabama, 11,574,430 in Arkansas, 17,424,438 in Florida, 6,582,841 in Louisiana, and 4,828,069 in Mississippi.

It must not be supposed that because these are comparatively old States, the best lands have been taken up. While it is perhaps difficult, if not altogether impossible, to secure lands in the vicinity of cities or large towns, or in near proximity to present lines of commercial communication, very desirable tracts may be obtained in sections not remote. Moreover, the construction of railroads in that part of the country promises to be undertaken with an energy commensurate with their importance in the development of the rich regions now lying fallow on account of distance from leading markets. What the iron rail has done for the plains and prairies and outlying regions of the West and further North, it may confidently be expected to do for the South, with its wealth of soil, salubrious climate, inviting natural scenery, and affluent products. The era of substantial progress for the South may indeed be said to have commenced with the termination of the war, which, obliterating the system of compulsory labor, and the monopoly of production by great landed proprietors, opened up the avenues of competition to all classes of citizens. The division of lands into smaller tracts has promoted a more systematic and thorough, and consequently more profitable mode of farming and planting. Evidences of a highly remunerative production must attract that immigration which is the invigorating life of States. The characteristics of soil, climate, and productions of the homestead land States of the South are so nearly similar, and are so generally understood, that it is not necessary to speak of them respectively at any length.

Mississippi, Alabama, Georgia, and Louisiana are the leading cotton-producing States of the Union. They each possess remarkable agricultural and economic advantages. The soil, fertile and varied, produces the principal cereals and a variety of fruits and vegetables, in

addition to cotton, sugar, tobacco, and rice. Numerous streams, lakes, and bayous afford easy means of intercommunication. Timber of a superior kind for building purposes and for fuel is abundant. The great success which has attended experiments in the growing of mulberry trees and the rearing of silk-worms augurs the introduction into those States of that important branch of industry.

Alabama furnishes superior grazing lands in the northern districts, and, in that section, a soil well adapted to the cultivation of wheat, maize, rye, oats, &c. In this State coal, iron, and valuable minerals exist in considerable quantities. During the fiscal year ending June 30, 1868, 124,085 acres were taken up under the homestead act of 1866. In the same time 102,824 acres were entered by homestead settlers in Mississippi.

In the lower portion of Louisiana there are fertile prairies which yield good crops of wheat, barley, and Indian corn, some cereals yielding two crops annually. There are 50,000 acres of swamp land in this State which may be reclaimed by drainage and embankments, accounted as productive as any within its boundaries. There are 6,500,000 acres of railroad lands in Louisiana, which may be bought at low rates.

The fruits of the tropics flourish luxuriantly on the soil of Florida. Its rich alluvial bottoms produce large crops of sugar and rice. It has been said that the area in this State suitable for the culture of cotton is amply sufficient to supply the demands of the United States for that commodity. Possessing a coast line of one thousand miles, it furnishes from its dense forests ship-building timber of good quality. Public land in great abundance may be had in the State. Rapid settlement along the coast is being made by persons intent upon the culture of fruits. Florida, with an area of over 59,000 square miles, has a population estimated at a little over 160,000.

Arkansas is divided into two sections by the Ozark Mountains. While that region lying upon the north possesses a climate and furnishes productions analogous to those of the northern States, that lying upon the south displays the general characteristics of the cotton States. The staple productions of the State are Indian corn, cotton, and live stock, and considerable crops of wheat, oats, and tobacco. The White River Valley is sought by those who cultivate the cereals and raise herds. To the west of the great forests of the Arkansas is "one of the most productive regions on the continent for corn, cotton, and tobacco." In the valley of the Red River cotton is the staple product. The valley of the Ouachita is extremely fertile and inviting. The valley of the Mississippi is, for the most part, low and marshy, and subject in places to inundation. These lands, however, will be eventually reclaimed by drainage, and the protection of levees, since Congress has given to States the control of such tracts.

MANNER OF ACQUIRING TITLE TO PUBLIC LANDS.

The following directions for acquiring title to the public lands are communicated by the Commissioner of the General Land Office:

There are two classes of public lands: the one class at $1 25 per acre, which is designated as *minimum*, and the other at $2 50 per acre, or *double minimum*.

Title may be acquired by purchase, at public sale, or by ordinary "private entry," and by virtue of the pre-emption and homestead laws.

1. At public sale, where lands are "offered" at public auction to the highest bidder, either pursuant to proclamation by the President or

public notice given in accordance with directions from the General Land Office.

2. By private entry or location. The lands of this class liable to disposal are those which have been offered at public sale, and thereafter remain unsold, and which have not been subsequently reserved, or otherwise withdrawn from market. In this class of offered and unreserved public lands the following steps may be taken to acquire title:

Cash purchases.—The applicant must present a written application to the register for the district in which the land desired is situated, describing the tract he wishes to purchase, giving its area. Thereupon the register, if the tract is vacant, will so certify to the receiver, stating the price; and the applicant must then pay the amount of the purchase money. The receiver will then issue to the purchaser a duplicate receipt, and at the close of the month the register and receiver will make returns of the sale to the General Land Office, from whence, when the proceedings are found regular, a patent, or complete title, will be issued; and on surrender of the duplicate receipt such patent will be delivered, at the option of the patentee, either by the Commissioner at Washington or by the register at the district land office.

Location with warrants.—Application must be made as in cash cases, but must be accompanied by a warrant duly assigned as the consideration for the land; yet where the tract is $2 50 per acre, the party, in addition to the surrendered warrant, must pay in *cash* $1 25 per acre, as the warrant is in satisfaction of only so many acres at $1 25 per acre as are contained in the tract located. A duplicate certificate of location will then be furnished the party, to be held until the patent is delivered, as in cases of cash sales.

Agricultural College Scrip.—This scrip is applicable to lands *not mineral*, which may be subject to private entry at $1 25 per acre, yet is restricted to a technical "quarter section;" that is, lands embraced by the quarter section lines indicated on the official plats of survey, or it may be located on a part of a "quarter section," where such part is taken as in full for a quarter; but it cannot be applied to different subdivisions to make an area equivalent to a quarter section. The manner of proceeding to acquire title with this class of paper is the same as in cash and warrant cases, the fees to be paid being the same as on warrants. The location of this scrip is restricted to three sections in each township of land.

Pre-emptions to the extent of one quarter section.—These may be made under the general pre-emption laws, upon "offered" and "unoffered" land; and in certain States and Territories west of the Mississippi, including that part of Minnesota east of the river, may have legal inception by actual settlement upon *unsurveyed* land, although in such cases no definitive proceedings can be had as to the completion of title until after the surveys are officially returned to the district land office.

The act of March 3, 1853, extends the pre-emption for one quarter, or one hundred and sixty acres, at $2 50 per acre to every "alternate" United States or *reserved* section along the line of railroads.

The act of March 27, 1854, protects the right of settlers on sections along the line of railroads where settlement existed prior to withdrawal, and in such cases allows the tract to be taken by pre-emption at $1 25 per acre.

Where the tract is "*offered*" the party must file with the district land office his declaratory statement as to the fact of his settlement within thirty days from the date of said settlement, and within one year from that date, must appear before the register and receiver and make proof of

his actual residence on and cultivation of the tract, and secure the same by paying cash, or by filing warrant duly assigned to the pre-emptor.

Where the tract has been surveyed and *not* offered at public sale, the claimant must file within three months from date of settlement, and make proof and payment before the day designated in the President's proclamation for offering the lands at public sale. Should the settler in either of the aforesaid cases die before establishing his claim within the period limited by law, the title may be perfected by the executor, administrator, or one of the heirs, by making the requisite proof of settlement and paying for the land: the entry to be made in the name of "the heirs" of the deceased settler, and the patent will be issued accordingly.

In those States and Territories in which settlements are authorized by law on *unsurveyed* land, the claimant must file notice of settlement within three months after the receipt of the township plat of survey at the district land office, and make proof and payment as required in the case of tracts which have been surveyed and *not* offered at public sale.

Homestead lands.—The original homestead act of May 20, 1862, gives to every citizen, and to those who have declared their intentions to become such, the right to a homestead on surveyed lands. This is conceded to the extent of one quarter section, or 160 acres, held at $1 25 per acre, or eighty acres at $2 50 per acre, in any *organized district* embracing surveyed public lands. To obtain homesteads the party must, in connection with his application, make an affidavit before the register or receiver that he is over the age of twenty-one, or the head of a family; that he is a citizen of the United States, or has declared his intention to become such, and that the entry is made for his exclusive use and benefit, and for actual settlement and cultivation. Where the applicant is prevented by reason of bodily infirmity, distance, or other good cause, from personal attendance at the district land office, the affidavit may be made before the clerk of the court for the county within which the party is an actual resident.

The amendatory act of March, 1864, relaxes the requirements of personal attendance at the district office to persons in the military or naval service, where the party's family or some member is residing on the land that it is desired to enter, and upon which a *bona fide* improvement and cultivation has been made. In such cases the said act of 1864 allows the beneficiary to make the affidavit before the officer commanding in the branch of service in which he may be engaged, and the same may be filed by the wife or other representative of the absentee with the register, together with the homestead application. His claim in that case will become effective from the date of filing, provided the required fee and commissions accompany the same; but immediately upon his discharge he must enter upon the land and make it his *bona fide* home, as required by the original act of May 20, 1862.

For homestead entries on surveyed lands in Michigan, Wisconsin, Iowa, Missouri, Minnesota, Kansas, Nebraska, Dakota, Alabama, Mississippi, Louisiana, Arkansas, and Florida, the total commissions and fees to be paid on minimum lands are as follows: On 160 acres, $18; on 80 acres, $9; on 40 acres, $7; on double minimum lands, 80 acres, $18; 40 acres, $9. On surveyed lands in California, Nevada, Oregon, Colorado, New Mexico, Washington, Arizona, Idaho, and Montana, the commissions and fees are as follows: On minimum lands, 160 acres, $22; 80 acres, $11; 40 acres, $8; on double minimum lands, 80 acres, $22; 40 acres, $11. By the act of 21st June, 1866, the public lands of Alabama, Mississippi, Louisiana, Arkansas, and Florida, are subject to disposal under the provisions of the homestead laws only.

Upon faithful observance of the law in regard to settlement and cultivation for the continuous term of five years, and at the expiration of that time, or within two years thereafter, upon proper proof to the satisfaction of the land officers, and payment to the receiver, the register will issue his certificate and make proper return to the General Land Office as the basis of a patent or complete title for the homestead. In making final proof it is indispensable, under the statute, that the homestead party shall appear in person at the district land office, and there make the affidavit required of him, by law in support of his claim. Where, from physical disability, distance, or other good cause, the witnesses of said party cannot attend in person at the district land office, their testimony in support of the claim may be taken where they reside before an officer authorized by law to administer oaths. Their testimony must state satisfactorily the reason of inability to attend the district office; and the credibility and responsibility of the witnesses must be certified by the officiating magistrate, whose official character must be certified under seal. Where a homestead settler dies before the consummation of his claim, the heirs may continue the settlement and cultivation, and obtain title upon requisite proof at the proper time. Where both parents die, leaving infant heirs, the homestead may be sold for cash for the benefit of such heirs, and the purchaser will receive title from the United States.

The sale of a homestead claim by the settler to another party before completion of title is not recognized by the General Land Office, and not only vests no title or equities in the purchaser, but is *prima facie* evidence of abandonment, and gives cause for the cancellation of the claim. To the government only may a claim be relinquished; and in such case the duplicate receipt of the settler should be surrendered with the relinquishment indorsed thereon; or if the duplicate has been lost, that fact should be stated in the relinquishment, duly signed and acknowledged.

When application is made for the cancellation of a homestead entry on the ground of abandonment, the party must file his affidavit with the local land officers, setting forth the facts on which his allegations are founded, describing the tracts and giving the name of the settler. Upon this the officers will set apart a day for a hearing, giving all the parties in interest due notice of the time and place of trial.

The expenses incident to such contest must be defrayed by the contestant, and no entry of the land can be made until the local officers have received notice from the General Land Office of the cancellation of the entry covering the same. As the law allows but one homestead privilege, a settler relinquishing or abandoning his claim cannot thereafter make a second entry. Where an individual has made settlement on a surveyed tract and filed his pre-emption declaration therefor, he may change his filing into homestead, yet such change is inadmissible where an adverse right has intervened, but in such cases the settler has the privilege of perfecting his title under the pre-emption laws. If the homestead settler does not wish to remain five years on his tract, the law permits him to pay for it with cash or warrants, upon making proof of settlement and cultivation from the date of entry to the time of payment. There is another class of homesteads, designated as "adjoining farm homesteads." In these cases the law allows an applicant, owning and residing on an original farm, to enter other land lying contiguous thereto, which shall not, with such farm, exceed in the aggregate one hundred and sixty acres. Thus, for example, a party owning or occupying eighty acres may enter eighty additional graded at $1 25, or forty acres at $2 50. Or suppose the

applicant to own forty acres, then he may enter one hundred and twenty acres graded at $1 25, or forty at $1 25 and forty at $2 50, if both classes of land should be found contiguous to his original farm. In entries of "adjoining farms" the settler must describe, in his affidavit, the tract he owns and is settled upon as his original farm. Actual residence on the tract entered as an adjoining farm is not required, but *bona fide* improvement and cultivation of it must be shown for the period required by the statute.

Lands obtained under the homestead laws are exempted from liability for debts contracted prior to the issuing of patents therefor.

Pre-emptors, in all organized districts where surveys have been made, can pay for their tracts either in cash or with warrants, except as to double minimum or $2 50 lands, within the lateral limits of railroad grants, it being required for the double minimum tracts that the warrant shall be taken as half the consideration, and the residue be paid in money.

UNITED STATES LAND OFFICES.

The following list shows the location of the land offices of the United States, in the respective public land States and Territories:

Ohio.—Chillicothe.

Indiana.—Indianapolis.

Illinois.—Springfield.

Missouri.—Boonville, Ironton, Springfield.

Alabama.—Mobile, Huntsville, Montgomery.

Mississippi.—Jackson.

Louisiana.—New Orleans, Monroe, Natchitoches.

Florida.—Tallahassee.

Arkansas.—Little Rock, Washington, Clarksville.

Michigan.—Detroit, East Saginaw, Ionia, Marquette, Traverse City.

Iowa.—Des Moines, Council Bluffs, Fort Dodge, Sioux City.

Wisconsin.—Menasha, Falls of St. Croix, Stevens's Point, La Crosse, Bayfield, Eau Claire.

Nevada.—Carson City, Austin, Belmont, Aurora.

California.—San Francisco, Marysville, Humboldt, Stockton, Visalia, Sacramento.

Washington Territory.—Olympia, Vancouver.

Minnesota.—Taylor's Falls, St. Cloud, Winnebago City, St. Peters, Greenleaf, Duluth, Alexandria.

Oregon.—Oregon City, Roseburg, Le Grand.

Kansas.—Topeka, Junction City, Humboldt.

Nebraska.—Omaha City, Beatrice, Lincoln, Dakota City.

New Mexico Territory.—Santa Fé.

Dakota Territory.—Vermillion.

Colorado Territory.—Denver City, Fair Play, Central City.

Idaho Territory.—Boise City, Lewiston.

Montana Territory.—Helena.

Arizona Territory.—Prescott.

Utah Territory.—Salt Lake City.

EXTENT OF THE PUBLIC LANDS.

Statement showing the area in acres of the several public land States and Territories, the quantity sold and entered under homestead laws, and the number of acres disposed of in each.

State and Territories.	Area in acres.	Quantity sold.	Entered under homestead laws.	Surveyed and unsurveyed, remaining unsold and unappropriated, June 30th, 1868.
Alabama	32,462,080.00	17,758,665.12	171,944.24	6,790,996.17
Arkansas	33,406,720.00	8,235,659.03	236,446.20	11,574,430.18
California	120,947,840.00	1,198,874.41	368,321.76	104,533,420.30
Florida	37,931,520.00	1,832,431.49	228,128.67	17,484,438.19
Illinois	35,462,400.00	19,879,408.27	272.63	424.67
Indiana	21,637,760.00	16,122,244.78	....	1,920.00
Iowa	35,228,800.00	11,587,240.35	362,954.05	2,902,528.06
Kansas	52,043,520.00	244,976.32	788,452.87	42,795,589.84
Louisiana	26,461,440.00	5,720,309.75	4,659.52	6,582,841.54
Michigan	36,128,640.00	12,265,566.12	1,171,732.11	4,614,078.26
Minnesota	53,459,840.00	2,127,314.18	2,439,759.64	35,534,118.75
Mississippi	30,179,840.00	12,201,037.03	121,710.15	4,828,069.11
Missouri	41,824,000.00	22,890,263.15	863,922.83	1,483,715.22
Nebraska	48,636,800.00	255,838.58	1,033,171.95	41,624,126.40
Nevada	71,737,600.00	60,403.35	11,654.54	67,085,697.12
Ohio	25,576,960.00	12,8[illegible]5,882.19	5,777.57	500.00
Oregon	60,975,360.00	232,064.39	397,289.98	52,518,014.32
Wisconsin	34,511,360.00	9,819,225.39	779,372.10	9,258,627.33
Alaska purchase	369,529,600.00	....	....	369,529,600.00
Arizona Territory	72,906,240.00	....	....	68,855,890.00
Colorado Territory	66,880,000.00	69,191.65	125,758.49	62,814,254.86
Dakota Territory	96,596,128.00	18,292.44	191,135.04	90,986,449.52
Idaho Territory	55,228,160.00	2,784.61	6,337.90	52,159,806.49
Indian Territory	44,154,240.00	....	....	44,154,240.00
Montana Territory	92,016,640.00	35.93	....	86,904,569.07
New Mexico	77,568,640.00	....	....	70,705,518.00
Utah Territory	54,065,043.20	....	....	48,976,310.20
Washington Territory	44,796,160.00	178,295.92	246,553.39	41,565,717.53
Wyoming Territory	62,645,068.80	....	....	59,164,787.80
Total	1,834,998,400.00	155,536,004.45	9,465,355.06	1,405,366,678.93

THE STATE REPORTS OF AGRICULTURE.

Annual reports of agriculture for the year 1867, have been received from the States of Maine, Massachusetts, New York, Michigan, Ohio, Indiana, Iowa, and Missouri, embracing all the volumes issued by State agricultural societies or State boards of agriculture, during the year, so far as known to this Department. While it is impracticable to reproduce, even in the most concise form, the entire contents of these local publications, a brief digest of the more important features of each is herewith presented, though in some instances the suggestions of individual contributors may not merit the fullest indorsement. Practical results are of more value to the farmer than detailed theories or speculations; hence, in gleaning from these several volumes, more attention has been given to the statements of facts—the results of actual experiment—than to the lengthy essays; while the reproductions from home and from foreign periodicals have been passed over entirely.

MAINE.

THE APPLE ORCHARDS OF NEW ENGLAND.

In a paper read before the State Board of Agriculture by Calvin Chamberlain, it is stated that New England soil once sustained the apple tree to a vigorous old age, but that farmers, relying too much on the permanence of existing orchards, and taking no note of climatic changes induced by the removal of forests, have suffered this interest to waste away to an alarming degree. A few individuals saw the error in time, and gave the note of warning, which had some effect; but the hard winter ten years ago, by laying waste the labors of many orchardists, discouraged general effort and caused a rapid decline in production. That the climate has changed since the first orchards were planted in the narrow clearings of the forest is understood, and also that the soils of the orchard farms differ in their constituent elements from their primitive condition; and that destructive insects have greatly multiplied is equally certain; but, with a growing conception of these negative influences, there now appears to be an increasing inquiry for nursery trees. Nurseries seem to have declined as rapidly as orchards, however, and in many sections none exist.

The writer advises farmers to return to the practice of raising their own apple trees, as worth much more than when grown at a distance from the farm. Any family may save seeds enough from good apples to plant thickly in the garden, in the spring, at least one row a rod long. When grown one or two years these trees should be transplanted, at intervals of one foot, in rows three feet apart. The transplanting is best done by taking them up in the autumn, and packing the roots in earth in the cellar. They may be grafted at any time during the winter, and reset in the spring, or they may be reset when lifted, in fall or spring, and budded or grafted the following year; or they may be allowed to go to the orchard as seedlings, and such only be grafted subsequently in the branches as produce inferior fruit. No one should attempt to raise an orchard until he is ready to give his trees such care

as is requisite for the production of a crop of corn or potatoes, as the apple tree must have care in all its stages from the seed to the mature tree.

The successful efforts of a gentleman in one of the eastern counties of Maine, in apple tree culture, practically illustrates the possibility of reviving the earlier interest and results in orchards in that section of the Union. The soil of the orchard referred to was naturally very poor and thin, being composed of a coarse, cold, and loamy gravel, lying on a light pan inclined to clay, and full of schistose stones. Six or seven acres were underdrained, four and a half feet deep. Three experiments were tried in planting the trees. In No. 1 the holes were dug eight feet in diameter and twenty inches deep, and filled with alluvial soil taken from a low island in the river. In the holes thus prepared one hundred trees were planted, twenty feet apart. In No. 2 the land was plowed in ridges twenty feet wide, the dead furrow coming where the rows were to stand. An ox-scraper eight feet long was passed across these ridges, and the contents dropped in each dead furrow, returning in the same line, drawing the other side in. These cavities were then plowed and scraped a second time, and an ox-cart load of black-ash swamp mud and about one bushel of slacked lime, well mixed, put into the holes. Some rich top soil was mixed with this deposit, and one hundred trees planted in the soil, when the field was plowed level. In No. 3 an acre was selected which had been cultivated with potatoes, corn, &c., and about one hundred ox-cart loads of muck and lime and about thirty loads of manure were spread upon it. A road-plow was then drawn through the land twenty inches deep. The following spring, the stones having been removed, the land was again manured, and plowed six inches deep, and one hundred trees planted upon it, not in it, the holes being not more than three or four inches deep. The land has since been dressed with muck, three-fourths of a cord to each twenty feet square, though not all at once, and the soil has been kept under cultivation. The other trees were planted in the ordinary method. The best trees are on field No. 3, on the deep plowing. Most of them have been planted since 1857, many of them since the spring of 1860. This season more than 150 barrels of apples were gathered by hand, and 100 bushels of cider apples picked up, the land at the same time yielding a large quantity of small crops—50 bushels of barley and about 800 bushels of potatoes. The gentleman referred to concludes that the same variety of scions will not grow in all trees; that a tree may be planted upon any soil, even a stiff blue clay, and be made to grow and do well; that all soils holding or retaining water must be underdrained, and if clay the drains must be under the trees; that a tree must be fed with those elements constituting its substance, and that such are contained largely in the muck upon which hard wood is growing, mixed with ashes; that the great enemy in our orchards is grass, which must not be permitted to grow in the same field with the trees; and that the orchard, at least in the region referred to, should be kept in constant cultivation. These observations do not apply to trees standing upon rock maple land.

PRODUCTS AND VARIETIES OF FRUIT.

Apples.—Joseph H. Smiley, of Vassalborough, has about one and five-eighths acre in orchard, raised from the seed and grafted principally with the Baldwin, Greening, and Tolman's Sweeting. About 140 trees have been in bearing several years, the remainder just commencing to bear. His crop in 1863 was 106 barrels, sold for $266; in 1864, 50 bar-

rels, sold for $162; in 1865, 104 barrels, sold for $616; in 1866, 160 barrels, sold for $667; each year reserving six or eight barrels for family use, not included above. Land formerly pasture; broken up in 1848, and planted with corn and potatoes, the trees being set the following spring. The orchard was planted and sown to grain alternately for six or seven years, and then seeded to clover; since that time it has been pastured with sheep, the trees being protected with stakes and laths.

Jacob Pope, of Manchester, sold from his orchard of sixteen acres 250 barrels of first quality of apples at $4 to $4 50 per barrel; thus harvesting over $1,000 worth from a rough piece of land, portions of which had never been plowed, but used for sheep-grazing. The trees were mostly the Baldwin, Roxbury Russet, and Rhode Island Greening.

Nathan Foster, of Gardiner, recommends the following list for general cultivation in that locality: Apples—Red Astrachan, Sidney Sweet, Moses Wood, American Summer Pearmain, Winthrop Greening, Somerset, Holmes's Sweet, Gravenstein, Fameuse, Tolman's Sweeting, Bellflower, Rhode Island Greening, Northern Spy. Pears—Doyenné d'Été, Rostiezer, Beurré d'Amaulis, Flemish Beauty, Nickerson, Fulton, Nouveau Poiteau, Belle Lucrative, Urbaniste, Winter Nelis, and Lawrence.

S. N. Taber, of Vassalborough, recommends the following apples for a family orchard: Early Harvest, Early Sweet Bough, Sops of Wine, Williams's Favorite, Gravenstein, Somerset, Porter, Queen's, Starkey, Hurlbut, Rhode Island Greening, Franklin Sweet, Sawyer Sweet, Baldwin, Golden Russet, Northern Spy, Tolman's Sweeting, and Bellflower.

THE USE OF FRUITS AND VEGETABLES.

Mr. Chamberlain, in a report upon this subject, argues that health and economy require more attention, on the part of our farmers, to the production and use of garden vegetables and fruits; and urges the reduction of the consumption of meat, and a greater reliance upon the former for the table, especially in the warm season, not only as a matter of health, but of economy. The kitchen garden should become a general and an important appendage to the farm, being made an object of annual and daily care. In support of the economical view it is stated that a growing animal, or a cow in milk, consumes daily of good hay about three per cent. of its own weight; that it takes 11 pounds of milk to increase the weight of a calf one pound; that 315 pounds of potatoes, 548 pounds of beets, 676 pounds of turnips, and 386 pounds of carrots are each equivalent to 100 pounds of hay; that an ox weighing 1,300 pounds will keep up his weight upon about 22 pounds of good hay per day; but, put up to fatten, he will require 44 pounds, upon which he will gain about two pounds per day. Substituting equivalents for one-half the hay, we have 69.3 pounds of potatoes, 120.4 pounds of beets, 148.7 pounds of turnips, or 84 pounds of carrots, added to 22 pounds of hay for daily feed, to produce two pounds of beef, live weight. An experiment in feeding hogs, from Boussingault's Rural Economy, is given: Four animals, each nine months old, weight 458.2 pounds; at the end of twenty-one days they weighed 620.8 pounds, increase 162.6 pounds; to attain which they consumed, of barley 151 pounds, beans 140.8 pounds, malt grains 440 pounds, equivalent in nutrition to 1,229 pounds of hay, or 3,871 pounds of potatoes, so that the quantity of nutritive matter, represented by 100 pounds of hay, produced 13.21 pounds of live weight. Otherwise expressed, 64½ bushels of potatoes produced 162.6 pounds of live hog. In another experiment, seven hogs, fifteen months old and in good condition, were put up to fatten, their weight being

1,691.8 pounds; at the end of 104 days they had gained 409.2 pounds: they consumed 772 pounds of barley, 1,042.8 pounds of peas, and 9,504 pounds of potatoes; giving equivalents, we have 26,245 pounds of potatoes; the provender equivalent to 100 pounds of hay gave 4.91 pounds live weight, or 456 bushels of potatoes made 409 pounds of live pork. Mutton is fattened at a cost about the same as beef. With such proof of expenditure of vegetables for the production of animal flesh, the writer concludes that course to be true economy which leads us to support ourselves on the products of the garden, the orchard, and the field; reducing our animal food to its minimum, below which vital energy will be lessened, and our usefulness abridged.

SOUR KROUT.

A letter to the secretary upon the manufacture of sour krout gives the following as the popular method of preparation among the krout-makers of Lincoln County:

The outside and loose leaves should be cut off and the heads quartered and thrown into a tub of clear water, from which they should be taken, one piece or more at a time, and placed in a small box, open at top and bottom, and running in the grooves of the krout machine, which is about four feet long, one foot wide, and six inches deep. The box runs over three or four knives, sometimes made of old scythes, fixed diagonally across the bottom of the machine. The edges of the knives are slightly raised above the level of the bottom, and when the box is moved backward and forward in the grooves, and pressure made with a small piece of board on the cabbage, the latter is cut into thin, small slices, which drop into the tub beneath the cutter. As the cabbage is cut, it is transferred to a clean barrel (a pork barrel is preferable) and pounded with a heavy wooden mallet. The more closely it is packed the better; and, with care, from 250 to 300 pounds of cabbage may be put into a barrel of 40 gallons. One pint of fine salt to the barrel is sprinkled with the cabbage as it is packed down. No addition of water is required. Fill the barrel to a point two inches from the top, cover the krout with large cabbage leaves, and place over the whole a wooden cover small enough to be inserted within the barrel, where it must be kept firmly, by a heavy stone, until the process of fermentation is past. Place the barrel within five or six feet of the kitchen fire, and in a few days fermentation will commence, which may be hastened by the addition of a little blood-warm water; a frothy scum will rise and run off, when the krout is all right and ready for use, and the barrel may be set in the cellar, porch, or shed. Freezing does it no injury, and it will keep in the cellar until March or April without depreciating, and longer in a cooler place. A barrel of krout can be made in two hours by two men. Any prejudice existing against sour krout, for want of cleanliness, is not well founded where even ordinary care is exercised in its preparation. There are various modes of cooking it, while some prefer it raw, eating it as a salad. It is frequently boiled, three hours or more, with salt pork cut into small pieces. Perhaps the nicest style is to fry it in pork fat or with the gravy from roast pork. For frying, it should be boiled two hours to make it tender. It is a wholesome, hearty food, and is particularly appreciated by men requiring a substantial diet, while it is also relished by many of more fastidious taste.

CULTURE OF BUCKWHEAT.

The report of Mr. Harries, on the culture of buckwheat, recommends increased attention to the production of this grain in Maine, where it

matures in about ninety days from sowing. The writer states that it can be raised as cheaply as oats, while one bushel of it is worth two of oats for making beef, pork, or mutton. When used for feeding purposes the flour and bran are not separated, and thirty to thirty-three pounds per bushel are obtained: in separating, the bolt divides it in about equal parts. It is asserted that the flour is worth as much as wheat flour in the family. If sown on land in high condition it will lodge, and not yield so much as on land in a lower state of cultivation. It will grow on poor soil, and yield a good crop for several successive years without seeming to make the soil poorer, as it is thought to receive a large share of its nutriment from the atmosphere, through its great amount of leaves. The best way to harvest is to cradle it, setting it up in small bunches to dry. It will not sprout at harvest time, and the poor man, without a barn, may raise it. It is best threshed on a bed made of small poles, supported at suitable height from the ground, the grain falling beneath. The grain is ready for the mill at any time. Preference is given to the rough variety, as not being liable to blight, and yielding more, while making as good flour as the smooth variety.

CUTTING HAY.

Samuel L. Boardman says, in a paper upon the agriculture and industry of Kennebec County, that farmers do not cut their hay soon enough; that hay, by the present mode of cutting it, loses a large part of its most valuable constituents; that to be properly cured, it should, when this operation is performed, resemble *dried grass* as much as possible; and, to accomplish this, it needs to remain exposed to the air, after cutting, only long enough to have the water dried out; and that the right time for cutting grass is when it contains the largest amount of matter soluble in water, and not after this has changed to woody matter, as when passing into seed.

The method of curing hay employed by Allen Lambard, of Augusta, is given as follows: He never commences cutting grass in the morning until the dew is all off, which is usually about 9 o'clock. It then lies until afternoon, when it is put up in bunches, in which state it remains through the night and all of the next day, without being disturbed. The second day after mowing, the bunches are all made over with a fork, commencing at the top, shaking it apart somewhat and rebuilding, thus bringing the bottom of one bunch to the top of the other. It then remains until the third day, when, if the weather is good, it is opened, has the sun for an hour or two, and is hauled in. If the weather is not good, it remains untouched until the next day. Hay cured in this way retains its sweetness, brightness, and all the leaves and blossoms until fed out: and not having been burnt up, the best part is not left in the field when it is harvested. The mixture of seed used in seeding—twenty pounds of clover and half a bushel each of herd's grass and red-top to the acre—gives pure grass of an excellent quality.

FARM FENCING.

In a report upon this subject Mr. Prince states that in 1860 there were in Maine 53,956 farms of more than twenty acres, upon each of which it is estimated there are 500 rods of fence, making an aggregate of 26,978,000 rods; that at least two-thirds of this is of wood, and liable to need repair every season, which, at ten cents per rod, will make an annual outlay of nearly $2,000,000, constantly increasing

with the cost of wood and timber; and that this expense must in time become burdensome in the extreme, unless some cheaper and more systematic mode of inclosure shall be devised. It is stated that embankment fences and hedge fence, though pretty to look upon, have been found impracticable in Maine. Another member said it should be a point with farmers to build fences that will last a lifetime. A fence made of pickets, with an iron post and stone foot, is becoming common in open fields devoid of stones, making an excellent fence, and one which will last twenty-five or thirty years. The most substantial fence is the cheapest. Better build a picket fence than to patch up a fence every year with long, straight sticks from the forest, that in a few years would make valuable timber.

SHEEP IN NEW ENGLAND.

At a meeting of the State board it was resolved that the interests of Maine farmers demand that more attention shall be given to the production of mutton, both for sale and for the farmer's table. The opinion was expressed that the keeping of sheep, primarily for the production of wool, cannot be profitably pursued for any length of time in Maine or in New England; that the advantages of the far west for sheep husbandry, and the portable qualities of wool, would so reduce the price as to cause the abandonment of the pursuit in the former section. An increased tariff on wool was regarded as only a temporary relief, which must hasten the time of its cheap production at home. As yet, the native grazing lands of the United States have hardly been reached by civilization. The Indian, the buffalo, the elk, and the wolf have had undisputed possession. These must soon give place to the shepherd and his flocks and herds, producing wool for the New England manufacturers, and meat for the miners in the mountains. A large part of the vast territory lying west of the Mississippi is admirably adapted to sheep husbandry, and the belief was expressed that the time would soon come when a pound of wool would be produced in the United States more cheaply than a pound of cotton. Yet New England should not be discouraged in sheep husbandry, as it will always have a market for mutton without competition. It was argued that the East can also produce finer wool than the West, the climate and condition of the new Territories not being favorable to the production of very fine wool, or the long combing wools for lustrous goods. The Merino was recommended as suited to the situation. It was stated that little good mutton is produced in New England, and no special pains are taken to raise it, though the section is possessed of the elements requisite to the production of mutton sheep in perfection. The farmer can produce no meat so cheap and convenient for his table; he can have it fresh or corned at any time; and it would be a cheap and healthy substitute for much of the pork now used. A resolution was also adopted by the board, that sheep husbandry ought to be encouraged not only as a direct means of support, but also as indirectly tending to maintain the productiveness of the soil, thus enabling it to support a larger number of producers under conditions more desirable than now enjoyed.

USE OF ARTIFICIAL FERTILIZERS.

A report by Mr. Wasson, discussing the question, "Can artificial manures be profitably used by farmers; if so, what kinds and to what extent?" holds that, only where adequate returns cannot be made to the

soil without paying out, should fertilizers be bought. Plaster, fish guano, and superphosphate are named, as occupying positions greatly elevated above other artificial fertilizers. The value of plaster in some localities is great, in others it appears to be utterly worthless, and it is difficult to predict, with any certainty, its effects upon any given crop; but, as it is cheap, every one can test its influence upon particular soils. Fish guano, the dried refuse of the porgy fisheries, is rich in nitrogenous matter, which is readily given out as ammonia, and proves an active stimulant to nearly all cultivated plants. The superphosphate is designated the great agricultural improvement of the age, and for the culture of corn in short seasons in that latitude is considered almost indipensable; nor is its employment less successful in the culture of roots, especially the turnip, the beet, and the carrot; while upon exhausted pasture lands it proves highly satisfactory, being urged as the only means, at least the cheapest, for renovating worn-out pastures, inaccessible to cultivation except in the use of artificial manures. As to the extent to which these fertilizers should be used, the writer thinks they ought not to be used in place of farm-yard manure, nor of any home resource for fertilization, but in addition to them, and also with the view of thereby increasing, through the increase of crops and consumption at home, the home supply of manure.

In the discussion which followed the reading of the report, several causes were given for the failure of artificial manures to possess the virtues expected of them. Thus, the cheap guanos come from countries where rain falls, and the soluble portions are washed out, leaving little of value except insoluble phosphates. Poudrette is usually made of night soil which has parted with most of its efficacy. Peruvian guano is sometimes adulterated largely with sand or soil. Superphosphate is sometimes made of inferior materials, and not unfrequently mixed with muck and dirt and other cheap stuff. The frequent failures attending the use of fish guano arise from loss by reason of its perishable nature; if rapidly and immediately dried, however, there need be no difficulty in preserving its fertilizing properties.

Fish guano contains a comparatively small amount of phosphate of lime; and, when freely used without supplying phosphates and other ash constituents of plants, there is liability to exhaustion of the soil, by reason of the large crops obtained, and which the farmer may think can be repeated for years in succession by subsequent additions of the fish guano, while in fact this has but enabled the more rapid drawing out from the soil of what was in it. The chief uses of fish guano are, first, for the growth of grass; and when the manure yielded by the consumption of the hay grown as a result of the use of the guano is returned to the same ground, a high degree of fertility may not only be established, but also fully maintained; second, for use in old gardens, where there are considerable accumulations of plant food yet in an inert and unavailable condition.

THE CONSTRUCTION OF BARNS WITH REFERENCE TO THE PRESERVATION OF MANURES.

A report by Mr. Farley suggests the construction of barns, with close or open cellars, so that the solid and the liquid manures made in them may be saved from waste, evaporation, or washing away, and so deposited as to allow of an admixture of muck, top-soil, rock weeds, leaves, straw, or other substances suitable for absorbents and compost. It is asserted that more than one-half of the animal manure made in the

State, during the season when farm animals are housed, is lost with the barn arrangements now existing. With barns properly constructed, this enormous waste may in a great measure be obviated, and the manure heap may be largely increased by the addition of absorbents and compost matter, which the animal manure thus saved will bear, and the increased heap possess sufficient strength for the production of the leading crops of the State. The compost manure is preferable to clear manure for top-dressing with reference to hay crops, for the reason that the former operates not only as a manure but as an addition to the soil itself, which is required in the top-dressing of sandy, gravelly fields. For top-dressing purposes five times the quantity of compost substances may be added, if of good quality. Probably nine-tenths of all their farms have the materials—either salt or fresh muck, top-soil, or rock weed—required for compost; and, when deposited, spring and fall, in suitable proportions to the solid and the liquid manures dropped in the barns, the hogs will do almost everything else requisite to prepare the heap for use.

MASSACHUSETTS.

The report of the secretary of the Board of Agriculture, and editor of the annual publication, Charles L. Flint, presents returns from twenty-nine local agricultural societies, which, with the State society, acknowledge receipts amounting in the aggregate to $136,712 92, and of disbursements $128,019 21; of which $63,435 65 were for current expenses, and $25,326 42 for premiums. Of the latter amount $15,245 16 was paid on live stock, $4,905 71 on farm products, $1,552 90 on farms, improvements, manures, &c., and $556 25 on agricultural implements. Of the amount paid on stock $6,401 45 was on horses, $5,658 06 on cattle, $965 50 on sheep, $799 on swine, and $497 75 on poultry. The premiums were awarded to 6,491 persons. The aggregate permanent fund of the societies is $342,282 41, and the value of their real and personal property, above indebtedness, $327,684 57. From the secretary's abstracts of county reports the following facts and experiments are gleaned:

FARM PROFITS.

Richard Webster, of Essex County, reports his receipts and expenditures on a farm of forty acres, for which he paid $1,950 in 1859, as follows: In 1860 sold $873 31; expenses, $464 25. In 1861 sold $652 33; expenses, $688 33. In 1862 sold $693 67; expenses, $834 16. In 1863 sold $1,115 80; expenses, $1,083 80. In 1864 sold $1,945 50; expenses, $1,371. In 1865 sold $2,274 16; expenses, $1,763. In 1866 sold $2,595 83; expenses, $1,647 70. In 1867 the receipts and expenditures were about the same as in the preceding year. When purchased, fourteen of the forty acres were what is called field land; the remainder bush pasture with alders, birches, &c., and would pasture three head of cattle. In 1860, on his best mowing field of four acres, he cut only three-quarters of a ton of poor hay. In addition to other improvements made, buildings, &c., have been added, at an expense of about $4,200. The farm is now estimated to be worth from $5,000 to $8,000.

PROFITS ON FARM PRODUCTS.

Corn.—O. P. Kellam, of Essex County, produced on three and three-quarter acres, 600 bushels of corn in the ear, valued at $450; eight tons butt stalks, valued at $64; and 40 tons top stalks, valued at $60; total,

$574. Expenses, $329 50, including $192 estimated for manure. Net profits, $244 50, or $65 20 per acre. The land was plowed eight inches deep, and 76 loads of manure turned under; harrowed, and furrowed, and manured in the hill with 20 loads of compost; planted three and a half feet apart each way, with 37½ quarts of yellow eight-rowed corn; cultivated three times each way, and hoed twice before haying, and the weeds hoed out 10th of August. English hay preceding crop. Soil, dark gravelly loam.

Joseph Goodrich, of Worcester, produced on one acre 111½ bushels of corn and two tons of stover, at a cost of $70 75, the manure being valued at $39 25. Land plowed fall and spring; 15 loads manure plowed in, and 250 pounds superphosphate and the same of plaster applied to the hill. Six quarts of seed planted, Carter variety, cultivated twice one way, and hand-hoed twice. Grass the preceding crop.

Luther Page, of Worcester, produced on one acre 111½ bushels of corn and three tons of stover, at a cost of $49 50, of which $27 was for manure. Land plowed in October six inches deep; 18 loads of compost applied in the spring; harrowed well, furrowed lightly one way; a small handful of superphosphate put in each hill. Nine quarts planted, of eight-rowed yellow and red mixed corn. Cultivated twice the same way. Followed grass.

Albert Stratton, of Worcester, produced on one acre 90⅞ bushels of corn, at an expense of $93 58, of which $58 50 is charged to manure. Followed grass. Land plowed half in November, half in April, seven inches deep; harrowed and furrowed each way; 20 loads of barn-yard manure spread, and 250 pounds superphosphate applied in the hill; seed put in with a planter, 12 quarts of Carter corn; cultivated and hand-hoed twice. No difference noticed between the portion plowed in the fall and that plowed in the spring.

Oats.—Eugene W. Day, of Essex, raised on three acres forty-one rods, 164 bushels of oats, valued at $164, and two and a half tons of straw, valued at $45; total, $209, at a cost of $59; net profit, $150. The land was plowed seven inches deep, sowed upon the furrow, and then harrowed twice. No manure used. Corn and potatoes the preceding crops. Manured with 40 cart-loads of barn-yard manure each year.

Spring wheat.—Luther Page, of Worcester, raised on one acre 35¼ bushels of spring wheat and $14 worth of straw, at a cost of $44 83, of which $25 was for manure. Land plowed six inches deep in September, and 15 loads of manure spread and harrowed in well; sowed two bushels of Canada wheat, harrowed and rolled. The crop followed grass.

S. R. Damon, of Worcester North, raised on one acre five rods and forty feet, 34⅚ bushels of spring wheat and 34 cwt. of straw, at a cost of $59—$30 for manure. Land plowed May 3, seven inches deep; cultivated and harrowed three times; 20 loads of manure spread broadcast after plowing; two and a half bushels of seed sown. Followed corn, which had been manured with 25 loads of stable manure.

Winter wheat.—Cyrus Kilborn, of Worcester, raised on one acre 34 bushels of winter wheat and two tons of straw, at a cost of $55, $25 being for manure. Land plowed in August six to seven inches deep; 16 loads of compost and 250 pounds of superphosphate of lime harrowed in with the seed; two bushels of Blue-stem wheat sown, which variety Mr. K. has sown for the past twenty years without deterioration. The preceding crop was grass.

Benjamin Davis raised, on five acres of sandy loam, 150 bushels of wheat. Clover sod, plowed once and harrowed, seed being sown broadcast on the 5th of September.

Winter rye.—Luther Page, of Worcester, raised on one acre 42$\frac{6}{7}$ bushels of winter rye and one and three-quarters tons of straw, at a cost of $40 75, including $24 for manure. Followed grass. Soil, a black loam, clay bottom. Plowed six inches deep in September, and harrowed thoroughly; 16 loads manure spread. Half bushel of white rye sown last of September; seeded down to grass again; harrowed and rolled three times.

Cyrus Kilborn, of Worcester, raised on one acre (less one rod) 24$\frac{1}{2}$ bushels of winter rye and one ton of straw, at a cost of $21. No manure used for the rye, which followed corn manured with 12 loads of compost. Soil sandy loam; plowed in September six inches deep; no other preparation. One acre of winter wheat in the same inclosure, with the same treatment, made a much more valuable crop than the rye.

Beans.—The same gentleman raised, on twenty square rods planted with three quarts of early white pea-beans, with two loads of compost and 40 pounds of superphosphate applied, 183$\frac{3}{4}$ pounds of beans, and 400 to 500 pounds straw, at a cost of $11 50. He thinks white beans planted on light sandy loam less likely to blast than those on black, moist land.

Onions.—Martin Johnson, of Worcester, raised on thirty-five rods 102 bushels of sound onions, at a cost of $33 50, of which $10 was for manure, used at the rate of 25 loads to the acre. Soil, sandy loam; not plowed, but cultivated before planting in the spring; harrowed and leveled with the back of the harrow. Variety, Yellow Danvers, planted with machine, and hoed and weeded three times. The two preceding crops were onions.

Ruta-bagas.—Ebenezer Bird, of Worcester North, raised on twenty square rods of light, gravelly soil, plowed six inches deep, with 90 bushels of manure applied in the drills, 2,745 pounds of ruta-bagas. Four pounds of seed used; cultivated and hoed twice. Followed grass.

Potatoes.—Abel Marshall, of Worcester North, raised on forty square rods of black, mellow loam, 51$\frac{1}{2}$ bushels of "Garnet Chili" potatoes, at a cost of $47 50, of which $25 was for manure. Plowed five inches deep, with 12 loads of manure spread on the sod and turned under. Nine bushels of seed planted, cut and dropped in between the furrows as deep as plowed.

Hay.—Mr. Hubbard's report on hay estimates the crop of 1865 at $13,195,274, and the value of neat cattle, horses, mules, and sheep $19,854,580; so that, for every dollar's worth of stock there was less than sixty-seven cents' worth of hay raised in the State; and that in 1865 there were 682,284 acres of grass land mowed, with a product of 622,671 tons; or about 1,825 pounds per acre. An instance is stated of a member of the board who cut from four acres last year 28 tons of hay. He kept 15 horses, and put all their manure upon this piece of land, which yielded three crops during the season.

FRUIT CULTURE.

The returns of industry of Massachusetts for 1865 give the value of fruits at $1,713,240, which does not include small fruits, but is confined principally to apples and pears. Estimating for the small fruits, the whole amount would probably reach $2,000,000 for the fruit product of the State. The amount consumed, however, is largely in excess of the production, particularly of apples, peaches, grapes, and strawberries, most of which are brought from other States to supply the markets. There has been a partial failure of crops for several years.

Apples.—Mr. Hyde, in a report upon apple culture in New England, recommends the cultivation of a due proportion of summer apples when near market; and, whether near or remote, enough of Early Harvest, Red Astrachan, and Early Sweet Bough for family use. For autumn, the Early Strawberry, Golden Sweet, Gravenstein, Fall Pearmain, Porter, Fameuse, and Fall Pippin; and, for cooking apples, the Drap d'Or and Dutch Mignonne. For winter he places the Rhode Island Greening at the head of the list, but names the Baldwin for dessert and cooking, the Spitzenburg for cooking, Hubbardston Nonsuch, Yellow Bellflower on sandy soil, Northern Spy, Roxbury Russet, and Tolman's Sweeting.

The Martha's Vineyard committee report that the varieties of apples most highly regarded by the farmers of the island are the Baldwin, Bunch Apple, Hubbardston Nonsuch, Porter, Rhode Island Greening, Pippin, Roxbury Russet, the old-fashioned Russet, Pignose, Gilliflower, Summer Sweet, Winter Sweeting, and Tolman's Sweeting.

George Pierce, of Middlesex, realized from an acre orchard of apples, containing about one hundred and fifty trees, $3,105 54, including the proceeds of other crops raised on the ground. The orchard has yielded a good crop annually for a number of years. About sixty of the trees are thirty years old, chiefly Baldwins and Porters; the remainder have been set about fifteen years, and in fruit about eight years; thirty-eight of the trees are of the Williams variety.

Pears.—The Massachusetts Agricultural Society recommend as the best six pears for general cultivation, the Bartlett, Seckel, Urbaniste, Merriam, Sheldon, and Beurré d'Anjou; second best, Brandywine, Doyenné, Boussock, Swan's Orange, Howell, Beurré Bosc, and Lawrence; third best, Belle Lucrative, Paradise d'Automne, Beurré Superfin, Marie Louise, Beurré Clairgeau, and Vicar of Winkfield.

The Martha's Vineyard committee report favorably upon the following list of pears: Doyenné d'Été, Jargonelle, Dearborn's Seedling, Bloodgood, Tyson, Bartlett, Flemish Beauty, Trescott, Buffum, Seckel, Louise Bonne de Jersey, Belle Lucrative, Beurré Clairgeau, Duchesse d'Angoulême, Vicar of Winkfield, Lewis, and Catillac.

Grapes.—The same committee approve the following grapes: The Concord, Delaware, Iona, Hartford Prolific, Dracut Amber, Diana, Northern Muscadine, Union Village, Catawba, Isabella, Sage, Logan and Rogers's Hybrids Nos. 15 and 19.

The following varieties suffered from mildew last year in Massachusetts, in the order named, commencing with those affected most: Creveling, Delaware, Diana, Iona, Israella, Rogers's Hybrids Nos. 3 and 15, Allen's Hybrid, Hartford Prolific, Concord, Martha, Blackhawk, and Clinton, the latter to slight extent.

Cranberries.—The Plymouth committee on this crop express the opinion that the culture of cranberries is still an uncertain business, but that success is more than possible, and, when secured, the profits are very large. The conditions necessary to success, however, are so imperfectly understood that, at the outset of an experiment, it is a matter of chance whether success or failure will follow. The piece of meadow awarded the first premium by the committee contains about seven-eighths of an acre, and was originally a huckleberry swamp. The swamp was cleared in 1861, and the plants were set in 1862. First fruit in 1865. Total expense of land, labor, &c., $500, the receipts for fruit in 1865-'66-'67 were $1,005, for 120 barrels—profit, $505, with the plants in fine condition, and promising well for the future.

Another lot of three-fourths of an acre of swamp and salt marsh was prepared and cultivated up to planting, at an expense of $164. In 1865

the yield was 95 bushels; in 1866 only 11 bushels; and in 1867 about 108 bushels. In 1864 the plants looked well, but were much damaged during the following winter—cause unknown—and the fruit was destroyed by the berry-worm the ensuing summer.

In proof of the uncertainty of the crop the committee state that neither of the two experiments for which premiums were awarded in 1863, as being the most carefully conducted and promising the best results, has proved remunerative. Both these meadows were prepared at considerable cost, and in both, owing to the location, the quantity of gravel was made greatly to exceed the quantity of peat accessible to the plants. The first patch above named, which has twice paid for itself in three years, on the contrary received only a thin layer of sand on a level bed of clean peat, which fact seems to indicate that the presence of peat in considerable quantities, if not essential to the growth of the plants, is at least conducive to the perfecting of their fruit. A few days spent in the examination of meadows already prepared, and in acquiring a knowledge of the methods pursued, and the materials used in their preparation, would enable beginners to profit by the experience of others, and to avoid many mistakes to which they would otherwise be liable. Notwithstanding the uncertainty of the business, the committee deem it worthy the attention of those having suitable locations and sufficient means for prosecuting it without interfering with other and more certain vocations.

Flowers.—The committee on flowers of the Plymouth Society, in their report urging increased attention to this branch, as well for profit as for adornment, state that the yearly sales of flowers in the United States amount to over \$3,000,000, New York sales exceeding \$400,000, and Boston \$200,000 per annum. Plymouth County, Massachusetts, pays over \$5,000 per year for flowers.

FARM STOCK.

Milch cows.—Mr. Johnson, in an essay on farm stock, says that the valuation of cows and heifers in the State in 1855 was \$4,892,291, and in 1865, \$6,537,634; products of the dairy in 1855, \$2,898,696, and in 1865, \$3,091,462. Allowing the same increase in beef and veal as in yield of dairy, there is a total advance of \$2,030,871. For beef Mr. Johnson recommends the Shorthorns, Devons or Hereford according to ability to feed large or small cattle most profitably; for milk, the Ayrshire, and for butter the Jerseys; and thinks the dairy, either for the product of milk or butter, by far the most profitable department for the farmers of eastern Massachusetts.

The Middlesex committee on stock report that for beef and working oxen to be grown upon the broad acres and rich soil of the West, the Durham should take the lead, but for rich milk, cream, and butter, to be produced upon New England soil, the Jersey should unquestionably be ranked the highest.

The Worcester South committee estimate that a cow giving only 1,500 quarts of milk a year, will, at five cents per quart, yield an income of \$75, leaving little profit above cost of keeping; one that gives 3,000 quarts yields an income of \$150; while one that gives 4,000 quarts yields an income of \$200. Allowing \$25 for extra feed for the latter, there are \$100 left above the profit of the poor cow. Such cows the committee think may be raised by putting the best cows to full-blood Ayrshire bulls. If the heifer calf has a small, long head; eyes not large but dark and lively; neck long and slender, tapering toward the head; shoulders

and fore-quarters light and thin; hind-quarters large and broad, with skin loose, thin, and soft, raise it; but if not possessing most of these points, reject it and try again.

Of the cows offered for premium in Middlesex, the Jersey cow, Lady Milton, had given the first week in June 120 quarts of milk, butter 15 pounds; first week of July, milk 144 quarts, butter, 18 pounds; first week in August, milk, 115 quarts, butter, 16 pounds; first week in September, milk, 107 quarts, butter 15 pounds. Kept in pasture during June and July, and in August and September received green corn fodder at night in addition. Yield in butter in July, on grass alone, 79 pounds; from 1st of June to 7th of October, on green feed without grain, 293½ pounds, or an average of nearly 16 pounds per week for eighteen weeks and three days. In winter the owner feeds on good hay, steamed roots, and corn fodder, mixed with a small quantity of shorts.

Jersey cow, May Day, twelve years old, gave an average yield of 20 quarts of milk per day during June and July; butter, July and August, 15 pounds per week, from sweet cream. Feed, grass, with one quart each of meal and shorts per day.

James Thompson, of Nantucket, states that from a Jersey cow three years old he had 336 pounds of butter in one year. The next year he had 906 pounds 3 ounces from three Jersey cows; and last year he had 14 pounds and as high as 16 pounds per week from one cow. In one week in November, 21 pounds were put up from two cows, after furnishing milk for three families, and butter for two families, not less altogether than 28 pounds for the two cows. They ate no more than other cows, and were fed on hay and roots, and allowed to do their own grinding.

Swine.—The committee on swine of Middlesex South recommend the feeding of milk and grain to swine, to be transformed into manure, as the readiest and cheapest means of supplying to the soil the properties exhausted by feeding milch cows. A thrifty hog, furnished with the materials, will make a cord of first quality manure in a season. In fattening swine, the committee think that, so far as money profit is concerned, the farmer will realize the greatest net gain by slaughtering his hogs at the age of eight to ten months. With the smaller breeds and thrifty pigs he can get a weight of 250 to 300 pounds; while, as commonly managed, the additional eight months add only about 100 pounds; and experience has shown that it costs but a trifle more to grow and fatten a weaned spring pig to ten months old, than to fatten a ten months' store-hog from July to December; under favorable circumstances it may cost less, and the net profit be in favor of the pigs.

A careful feeder put three shotes, Suffolk and Mackay, to fattening July 1, when their weight was 200 pounds each. They were fed 53 bushels mixed grain, two-thirds corn and one-third oat-meal, costing $47 15. After five months' feeding, their dressed weight was 395, 380, and 343 pounds. One bushel of meal made nine and three-quarters pounds of pork, the latter costing nine cents per pound.

One of the committee bought three six-weeks pigs, Mackay and Chester, in early spring; weight 30 pounds each. They were fed 46 bushels of grain, two-thirds corn and one-third oat-meal, costing $43 78. Their dressed weight, at eight and a half months old, was 321, 295, and 271 pounds. One bushel of meal made 16 pounds of pork. The pork cost five and a half cents per pound. In the first case the corn cost seven cents and the oats fifteen cents per bushel less than in the latter, making the advantage still more decided on the side of the pigs.

The committee also favor the use of cooked food in fattening. Experi-

ments quoted show that field feeding on whole corn required a bushel of corn to add eight pounds of flesh to the animal; cooked corn meal moderately salted, with some whole corn fed after it, increased 12 hogs over 100 pounds each in seven weeks, one bushel making a fraction over 14 pounds of flesh; four pigs, bought in April, at six weeks old, fed on skim-milk with a handful of whole corn to each pig daily till July, and afterwards uncooked meal, two-thirds corn and one-third oats, as they would bear it, were killed at nine months old, and weighed, when dressed, 1,104 pounds, average 276 pounds. They ate 61 bushels of meal, costing $58 37; one bushel of meal making 18 pounds of pork; cost of pork, including first cost of pigs, seven and a half cents per pound.

Poultry.—The Middlesex South committee give the following statements: 15 hens, mostly Leghorns and Black Hamburgs, laid in ten months 191 dozen eggs. Profits on eggs sold, chickens raised and sold, &c., $89 81; expenses, 20 bushels of corn, $24; net profit, $65 81. Fowls were allowed to run at large, and were fed well three times a day. Another lot of 15 hens and one cock, mixture of Leghorn and native breed, laid 181 dozen eggs, which, with 16 chickens, brought $66 78; expenses, nine bushels of corn and six bushels of barley, $18 75; net profit, $58 03. Fowls run at large, fed twice a day in winter and once in summer. A flock of 113 Brahmas, in September, 1866, increased to 163 in one year, besides supplying eggs to the amount of $232 80; fowls sold, $75 28, making, with the 50 increase in flock, $408 08; expenses, $145 03; net profit, $263 05, taking no account of the droppings of the chickens. The Bristol Central committee recommend the Brahmas and Dorkings for the table; the Leghorns and Hamburgs for eggs; the Games and Dorkings, where all qualities are required of a high degree of excellence; and if pure breeds are not wanted, at least a game cock to improve the stock of every yard.

DRAINAGE.

A piece of rough pasture land in Essex County, two and seven-eighths acres, overgrown with alders, birches, and huckleberry bushes, and more or less covered with stones, was cleared up and underdrained with the following results: Debtor account from 1863 to 1867, inclusive, reached $1,506 85, including cost of land, $120, draining, plowing, seeding, harvesting, &c. Total receipts for the same time, counting the land worth $350 in 1867, $2,462. Profit $955 for the five years, leaving the land in good condition, thoroughly underdrained three and a half feet below the surface.

An acre of swamp land, purchased for $17 in 1864, ditched and worked at an expense of $100 for the four years following, for ditching, manuring, cultivating, harvesting, &c., produced in the same time potatoes and hay to the amount of $132, leaving the acre worth $100 instead of $17.

In a discussion upon drainage, Henry F. French expressed the opinion that any land, in which water stands at any season stagnant within two or three feet of the surface, would be benefited by drainage; that tile drainage will be found cheaper than stone, when the former can be obtained at $16 per thousand, delivered; that, as a general rule, the tiles should be put four feet deep if there is fall sufficient to carry the water off; and that, on ordinary loamy soil, or in peat swamps, side drains may be put thirty to forty feet apart, and be pretty sure of good results, if four feet deep; the deeper they are, the farther apart they may be. Tan is recommended for covering the joints; also turf and saw-dust.

In reference to the effects of drainage, Mr. Brown remarked that it makes cold land warmer, wet land dryer, dry land wetter, heavy land lighter, and in some cases light land more compact; and that land thoroughly drained, if it is anything like hard land, can be cultivated at about one-half the cost of wet land. He believed that all lands have inherent powers of self-recuperation. If the land is skimmed over with a crust, it may remain so for a hundred years, and not become fertile; but remove that crust, and get it into a fine tilled surface, and it will improve from year to year; vegetation will spring up and grow luxuriantly. One of the effects of drainage is to give land a chance to do something for itself. That will help it much, without the aid of plowing, manuring or seeding. He knew of a meadow that had been covered with hassocks from three to ten inches high. A drain was run through the entire length. One side was drained by lateral drains, twenty feet apart and four feet deep. In two or three years, without the use of a plow, manure, or seed, every hassock disappeared from the half so drained; the ground became smooth and beautiful, and timothy came up three or four feet high, and some of the heads measured nine inches in length; while on the other side, where no lateral drains were made, the hassocks remain to this day.

MANURES.

The Essex committee on this subject, while according merit to guano and other high-priced fertilizers, say they are beyond the reach of the practical farmer, who must rely upon the barn-yard, the stable, the privy, and waste animal and vegetable material, whether grown upon the land or in the sea, all of which should be husbanded with the utmost care, and their volume and power be multiplied by forming compost with peat, loam, and, in some cases, sand. As much poudrette can be made from a single load of night-soil, by making compost with meadow mud or muck, as can be purchased for $25 or $30, and of as good quality. Sea manure, consisting of kelp and mosses or rock-weed, when mixed with an equal quantity of muck, will make compost equal to the best stable manure. It is recommended that the manure made during the summer be applied directly to the land, and plowed in after harvest, the land being then plowed twice in the spring before planting. This process would not be advisable on leachy land, but on other soils it has been practiced with much success.

The premium pens of manure in Nantucket were made up of thirty loads of peat mud, fifty loads of sea-weed, fifty loads of sods from rich ridges where fences had been, and all the refuse bedding and green matter around the farm, hauled at times when the man and horse would have been doing little else, together with the droppings of four cows, one horse, one bull, and six hogs. The cost of the peat mud, sea-weed, and sods was about $28. At the end of the eighth month there were 2,700 cubic feet of manure, or 220 loads of twenty bushels each, at a cost of only $28, aside from the droppings of animals, and equal in quality to manure for which $1 per load would be charged.

Muck.—Mr. Smith, reporting upon manures, says of muck that it is especially adapted to forming compost with manure; and, when mixed with ashes, makes a compost nearer to stable dung than anything we have. An experiment is given with this mixture, used in the drill for English turnips. A large portion of the field was manured with a compost of barn-yard manure, the remainder with muck and ashes, four bushels of ashes to twenty-five bushels of muck. The crop fertilized with

the latter exceeded the other in luxuriance and yield. In another instance a field of ten acres was to be planted in corn. In the autumn 450 bushels of muck and 1,000 pounds of fish manure per acre were carted on in several piles. In the spring 180 bushels of barn-yard manure per acre were mixed with the muck and fish, being worked over three times. The land was plowed, the compost spread, and harrowed in. The result was 70 bushels of corn to the acre. Mr. Smith urges the free use of muck upon all sandy or gravelly soils, to be placed in the barn-yard and mixed with manure.

Hen manure.—In speaking of the value of hen manure, Mr. Ward stated that last season he plowed up about ten acres, and carted on about thirty loads of manure to the acre; and at planting time took the hen manure made during the year, and dropped in each hill as much as one would take up in his fingers, the whole going over about an acre. The result was a yield of sixty per cent. more potatoes on the portion where the hen manure was used than with the other manure alone. It was stated that $10 worth of manure can be made from twenty-five hens by forming compost with peat or rich sod.

NEW YORK.

The report of the Executive Committee of the New York State Agricultural Society, Colonel B. P. Johnson, secretary, speaks favorably of the agricultural condition of the State, and claims that, as a whole, the farming interests are advancing; and that, taking the State together, the year was one of progress. The treasurer reports the average total receipts of the society, for each of the ten years from 1858 to 1867, to have been $14,511 57, only $805 of which came from the State treasury; and the total average yearly expenses were $13,618 08, making the average annual savings $893 49. The accounts for 1867 show receipts from all sources, including balance on hand at beginning of year, $40,597 99; total disbursements $27,687 48—leaving assets of the society $12,910 51, less $1,055 subsequently paid for damages to fair buildings by tornado. During the year reports were received from fifty-one county societies and thirty-five town societies and farmers' clubs, all of which are apparently in prosperous condition, pecuniarily and otherwise.

The volume contains elaborate reports upon the Texas cattle disease, illustrated by colored plates, but the magnitude of the investigation precludes the presentation here of even a summary of the results.

THE LITTLE FALLS FARMERS' CLUB.

From the discussions before the Little Falls Farmers' Club are compiled the following reports of experiments:

Muck.—Mr. A. L. Fish stated that twelve years ago he drew out 3,000 loads of muck, and applied it at the rate of fifty loads to the acre, pulverizing and mixing it with the soil. The result was good crops without further cultivation. Two years later he drew out 4,000 loads, and applied it at the rate of 100 loads to the acre, spread with a plank to which was attached a tongue to hitch the team. The land was planted to corn. After taking two crops from the land it was put down in meadow, and it has produced at the rate of two tons of hay per acre ever since, though before the application it did not yield one ton per acre. It did not act so quickly as manure, but the effect was more lasting.

Bone dust.—Mr. Hollingworth stated that fifteen years ago his farm was considered a barren, worthless tract, covered with briers, wet and swampy. He first underdrained, laying the drains with stone, the main line four and a half feet deep, the lateral drains two and a half to three

feet deep. Sixteen acres were plowed in the fall and left fallow one year, when the refuse of 8,000 head of cattle was drawn upon it, consisting of the waste from the kettles after boiling the fat, and other refuse parts of cattle used in soap manufacture. Part of the lot was then covered to the depth of five inches. The next spring it was plowed and harrowed, and in the fall sown to rye. The winter was unfavorable to winter grain, and in the spring scarcely a blade of rye could be seen; but, as the season progressed, it began to show itself, and the result was a fine crop, the straw growing seven feet two inches high. The grain averaged about 52 bushels to the acre, 62 pounds to the bushel. Having been seeded to grass at the same time with the rye, a good crop was cut that fall; and every year since the land has produced heavy crops of grass with no additional manuring. The grass is chiefly timothy, and the first cutting yields three and a half tons per acre, with a large second crop. Though in grass seven years, the land is just as productive as at first. Mr. Hollingworth has 60 acres in grass from which he had the following cash receipts in 1867: Six tons at \$22, 50 tons at \$14, 29 tons at \$15, and 15 tons at \$20—\$1,567; to which must be added 34 tons consumed on the place, making, at \$15, \$510, or a total of \$2,077. He has applied ground bones at the rate of 70 bushels to the acre. From 14½ of the 16 acres above referred to were taken, in 1867, at first cutting, 39½ tons, cut 21st June. A second crop of four large loads was taken from two and a half acres, the remainder not being cut.

Rotted vs. *unrotted manure.*—Judge Owen owned twelve acres of the poorest land on the Mohawk. He applied 400 loads of fresh or raw stable manure, with but little improvement to soil or crops. He then put on 1,000 yards of well rotted dung which had been accumulating for five years, making a solid mass of rich manure. The field became a garden by this treatment, and illustrated the superiority of rotted over unrotted manures.

Liquid manure.—About fourteen square rods of the lot referred to was planted with melons. The plants came up, but the sun dried and hardened the clay, and the vines did not thrive. A wheel-barrow load of thoroughly decomposed dung was then taken from the center of the pile, and thrown into a barrel of water. By watering the plants with this liquid, they began to grow vigorously. They were thinned out to two in a hill, and the application continued, the barrel being refilled with water and manure from time to time. When the plants got fairly under way, they made a growth of ten inches in twenty-four hours, eventually covered all the ground, and made an enormous yield. One of the melons weighed 28½ pounds, and six others weighed 120 pounds. The patch supplied the family through the season, and in the fall half a dozen wagon loads of unripe melons were taken off. The owner thinks the liquid from fresh manure of not much account—it must be perfectly decomposed.

Foot-rot in cows.—For a dozen years or more the cows of Herkimer and adjoining counties have been troubled more or less with foot-rot. The disease makes its appearance sometimes between the claws of the foot, often in the heel, and extending up the leg, causes extreme lameness, loss of flesh and loss of milk. It often runs through a whole dairy, and its appearance is becoming every year more common. Mr. Whitman stated that he had found an efficient remedy. He makes an ointment of lard and red precipitate, one part of the latter to four of the former, to be applied to the affected parts and rubbed in; or in bad cases, when the disease is in the heel and upon the leg, worked in by holding a hot iron near the foot. The foot should be cleaned before the

application, by washing well with soap and soft water. One application if thorough, will generally effect a cure; but if all parts are not reached by the ointment, a second application should be made in forty-eight hours.

Profits of dairy farms.—Mr. Myers makes the following estimate of receipts and expenditures of a dairy farm in Herkimer County:

Receipts: 45 cows, averaging 400 pounds of cheese per cow, 18,000 pounds, sold at $14 30 per 100 pounds	$2, 574
Expenses: Labor and taxes $1,126; interest on land at $75 per acre, $980; interest and depreciation on 45 cows at $60 each, 10 per cent., $270; keeping team, $150; repairs to buildings and utensils $100; incidentals, $50	$2, 676
Loss on the business	$102

Mr. Myers says there are many expenses not enumerated, while the interest and depreciation of stock are too low. The total receipts of a dairy farm of 81½ acres and 20 cows are given as $1,271 32. Expenses, making no account of the land, female labor or superintendence of owner, $1,305; loss, $34 33. Another dairy of 50 cows: Products, $2,800; expenses, throwing out the interest on farm, family services, &c., $2,544.

Buffalo grass.—Mr. Harris Lewis exhibited samples of grass he had found in Wisconsin under the preceding name, and which he considered the most valuable he had seen for grazing. He found it growing over an area of 90,000 square miles. It grows in tufts, like orchard grass, and stock eat it greedily. When cut for hay it will give two crops of two tons each in a season, the second crop growing and maturing from the last of June to the 25th August. The plow is fatal to it. It grows in all soils, stands frost well, and is enduring. When designed for hay it should be cut twice.

Indian meal for butter making.—Judge Owen said that he found no ground feed so good for butter making as Indian meal; he had made a number of experiments in feeding, and the best results were obtained by feeding it dry. In this state the animal took it slowly, moistening it with saliva and thoroughly masticating it. In feeding it wet, he thought it passed directly to the third stomach, and hence was not properly assimilated. He had experimented with a large cow of the Holderness breed, to see how much meal could be fed with profit, and found that two quarts twice a day was all she would bear. This, in addition to hay, brought down the milk in large quantities. By such feed this cow yielded fourteen pounds of butter per week. Her highest product was forty-one pounds in fifteen days, besides thirty quarts of milk used in the family.

PROGRESS OF AMERICAN DAIRYING.

Mr. X. A. Willard, in a review of the progress of American dairying, states that Herkimer County, New York, is the oldest dairy district in America, the first cheese dairy being established there nearly eighty years ago. The American dairy now represents a capital of more than $600,000,000. The cheese product of 1867 sold for $25,000,000, and the butter product for more than $100,000.000. In 1864 the butter product of New York alone was nearly 85,000,000 pounds, and the cheese 72.000,000 pounds—the value of the two products being, at a very moderate estimate, more than $50,000,000. The wheat crop of the State in

1864 was 6.000.000 bushels, oats 19.000.000, rye 2.000.000, barley 3,000.000, and corn 17.000.000. The product of the New York dairies, therefore, sold for more than the entire grain crop of the State. The wool-clip that year was not quite 16.000.000 pounds, which, at $1 per pound, amounted to less than one-fourth that from the dairy. If we add the value of the pork made from whey, the calves raised, and the beef and milk sold, we can hardly place the annual product from the dairy farms of New York below $100,000,000.

In 1840 the value of the dairy products of New York—butter, cheese, and milk—was estimated by the United States census at only $10.496.000; and in all the States about $34.000.000. In 1850 the product of butter in all the States and Territories was 313.345.306 pounds, and the cheese 105.535,893 pounds. In 1860 the butter product had reached 469.681.372 pounds, and the cheese 103.663.927. The value of these products in 1860 could not have been less than $200.000.000. The cheese product of 1867 is estimated at 200,000.000 pounds, half of which was made in New York.

The cheese product of Great Britain in 1867 is estimated at 179.000.000 pounds. The amount of Dutch cheese sent to England in 1866 was 80,000,000 pounds. An approximate estimate of the annual consumption of cheese in Great Britain is 309.000 000, as follows: Home-make, 179.000.000 pounds; from Holland, 80.000.000 pounds; from the United States, 50,000,000 pounds.

The consumption of cheese in the United States and Canada is estimated at about 160.000.000 pounds per annum. This makes 469.000.000 pounds for Great Britain and America. Against this demand we have 179.000.000 pounds made in Great Britain, 200.000.000 pounds in the United States, and 15.000.000 pounds in Canada—total, 394,000,000 pounds. Deficiency for the supply of the two nations, 75.000.000 pounds. It is stated that France is competing with England for Dutch cheese, which must decrease the imports into Great Britain from that source. On the other hand, Sweden is entering the field as a dairy district, and will hereafter compete with the United States in the English markets. All these facts seem to indicate that there is danger of pushing the cheese dairying of America beyond ordinary consumptive limits.

In regard to the quantity of cheese needed abroad, the secretary of the London Board of Trade writes that the Americans should bear in mind the fact that Great Britain doubles in population every forty years; and hence the consumptive demand for cheese will increase in that proportion. This consideration, with the fact that there is great probability of a very important decrease in the manufacture of English cheese from year to year, gives hope that the dairying business may be sustained in this country if our people continue their efforts to improve the quality of both butter and cheese.

APPLE CULTURE, ITS PROFITS, ETC.

During the discussions at the State Fair, Mr. H. T. Brooks, of Wyoming County, read a paper advocating the enlarged cultivation of apples in the State of New York, as one of the best means of augmenting healthy human food, in which he expressed the opinion that by no process can so much nutriment be so cheaply extracted from four square rods of ground as by planting an apple tree in the center, and giving it good cultivation. In comparing the products of various crops, Mr. Brooks stated that General Mills, on the Genesee Flats, once raised 47 bushels

and 11 pounds of wheat to the acre on 80 acres; Captain Scott, of Wyoming County, about 1822, raised 500 bushels upon 10 acres: and Simon McKenzie, of Caledonia, 60 bushels to the acre. General Mills is said to have raised 115 bushels, and John Shelden, of Livingston County, 116 bushels of shelled-corn to the acre. One hundred bushels of oats have been produced frequently, and 400 bushels of potatoes. Paul C. Sprague, of Covington, raised at the rate of 700 bushels to the acre. Onions have been raised at about the same rate, and carrots may be estimated at double that quantity. He estimated, as the largest possible yield, corn at 140 bushels, wheat at 60, potatoes at 700, and carrots at 1,400 bushels to the acre. This would give 3½ bushels of corn, 1½ of wheat, 17½ of potatoes, or 35 of carrots to four rods of ground. Mr. Dodge picked 60 bushels of apples from a tree in Maryland, 12 miles from Washington. Major Bumphry, of Rochester, New York, reports a tree that gave 75 bushels at a single picking. Will any one deny that 75 bushels of apples are equal in nutritive value to 3½ bushels of corn, 1½ of wheat, 17½ of potatoes, or 35 bushels of carrots? Colonel Hannum, of Genesee County, picked from one tree in Massachusetts at least 80 bushels of apples; and a tree in Duxbury, Massachusetts, bore in a single season 121½ bushels. These are comparisons of extreme products of all the crops named.

Mr. Brooks then compared ordinary yields. Potatoes have been considered the cheapest food in general use, but of late years the average yield has been less than 100 bushels to the acre. Wheat will not exceed 15, and corn 35 bushels to the acre. The orchards of western New York, taking one year with another, good culture with bad, will average four bushels to the tree, or 160 bushels to the acre. So we have over 1½ bushel of apples for one of potatoes, 4½ for one of corn, and 10½ for one of wheat. The comparative value is an open question, but the apples in this comparison are greater in nutritive value than either the wheat or the potatoes. Corn is nutritious and productive in an eminent degree, but 4½ bushels of apples are about equal to one of corn; and, for the purpose of mixing with dry or concentrated food, the apples are preferable. For feeding cows or hogs, he would boil or steam two bushels of apples to one of meal, and rather than feed meal clear, would exchange one bushel of corn for 4½ of apples. In addition to the 160 bushels of apples per acre, it should be remembered that crops of grass and grain are also grown on the land. Apples need the ground, the whole of it, and all it contains: but the roots and branches of the trees are haggled and mangled, and the soil is exhausted in the production of other crops.

In reference to the actual profits of apple-growing, Mr. Brooks said that their orchards, in full bearing, yield an average of one barrel of marketable fruit to the tree, the yield depending greatly upon the kinds of fruit, as well as upon the vigor and healthfulness of the trees. The Spitzenburg, Fall Pippin, Yellow Bellflower, Fameuse, and other highly esteemed varieties, are now seldom planted, because they yield a light product or the fruit is imperfect, while the Roxbury Russet, Baldwin, Greening, Twenty-ounce apple, Tolman's Sweeting, Dutch Pippin, &c., bear much better. The average price, for the last ten years at Cuylerville, on the Genesee Valley canal, has been \$2 per barrel in the fall, and \$2 80 in the spring. Forty trees to the acre, yielding one barrel each, would give in the fall \$80 per acre; if sold in the spring, \$112. One man near that place has just sold his crop of seven acres, 2,200 barrels, netting \$6,600, or nearly \$1,000 per acre. An acre in grass would not give more than \$12, or in corn or wheat more than \$25. Should the

yield be reduced to one-half barrel to the tree, apples would still be the most profitable crop. Mr. Brooks claims, however, that the yield of the orchards can be doubled by good cultivation. Large yields are not uncommon: thirty-three bushels were picked from a tree in Middlebury; four trees of Greenings, in Le Roy, yielded 160 bushels; one Baldwin tree, in Perry, yielded 42 bushels, which were drawn at one load, and sold for $60; the product of two trees, in Middlebury, sold for $100; in 1865 the product of 80 trees, growing on three acres in Alexander—1,050 bushels—sold for $1,575; the fruit from 33 trees of the Northern Spy, in Middlebury, sold for $900; from 50 trees, in Hess Road, in 1865, the owner sold 288 bushels for $465; in 1866, from the same trees, 144 bushels were sold for $187; and last year 468 bushels, were sold for $421. This orchard occupied less than two acres, and gave an average of six bushels to the tree for the three years. Three men in Newfane, in 1867, sold 2,700 barrels of apples. One of these men has ten acres in orchard—mostly grafted ten or twelve years ago—near the lake shore; soil a gravel, six feet deep, with clay beneath; timber, oak and chestnut; trees pruned lightly every year; distance apart, twenty-seven feet: he crops every year with corn, barley, or oats; plows five inches deep, and manures every third year with forty loads barn-yard manure to the acre. This orchard yielded 300 barrels in 1865, selling for $1,620; 360 barrels in 1866, $1,422; 750 barrels in 1867, $2,062; average per acre for the three years 47 barrels, $170 per acre; crops light the last three years. Eighty trees in Covington, in 1867, yielded $550 worth of fruit, or $190 per acre. This orchard is trimmed every year, and plowed and manured every other year. A four-acre orchard, at Youngstown, yielded 500 barrels in 1867—one of the trees, a Greening, over fifty years old, yielding 26 barrels. Twenty trees, in York, produced 163 barrels of marketable apples in 1865, which sold for $779 50. A forest, about forty rods distant, incloses this orchard on three sides, north, east, and west. From six acres of orchard, in Bethany, Genesee County, there were sold, in 1862, 750 barrels of apples for $2,370; in 1863, 540 barrels, for $1,790; in 1864, 600 barrels, for $2,100; in 1865, 810 barrels, for $4,500; 1866, 157 barrels, for $863; 1867, 670 barrels, $3,000—paying over $400 per acre during the whole time. This is an old orchard; for ten years after it came into bearing it was allowed to take care of itself, and during those years it did no better than ordinary orchards; a new course was adopted; it was annually and prudently trimmed, heavily manured, plowed very shallow, and left for another year; then cross-plowed and harrowed, and suffered to lie two years without being cropped; the same process was then repeated, with the results stated. A neglected and unfruitful orchard, in Bavilion, was trimmed, manured, and plowed, when it bore abundantly—the seven acres yielding its owner $6,000 in six years. An orchard of 100 old trees, that did not yield over 20 barrels, changed hands three years since, when it was manured regularly and heavily, pruned annually, and the first year it yielded 56 barrels, the second 92 barrels, and last year 130 barrels. Five years ago a farmer piled his manure in his orchard between two large Twenty-ounce Pippin trees, which had borne only every other year, and then not over from seven to nine barrels; since the manure deposit, they have borne every year from 11 to 21 barrels.

In reference to varieties, Mr. Brooks says the Roxbury-Russet is their best keeping apple, and if properly grown, carefully preserved, and held to the proper time, will yield more money than any other apple. It is hardy, and yields abundantly. The Northern Spy is an abundant bearer, but requires a better soil, more pruning and thinning of fruit, and does

not yield so many marketable apples. The Baldwin gives more fruit per tree fit for market than any other prominent apple; and at least nine-tenths of all the apple trees set in Western New York, during the last ten years, have been Baldwins and Russets. Every person who has an acre or two of land should have two trees each of the Early Harvest, Early Joe, Sweet Bough, Red Astrachan, Maiden's Blush, Fall Pippin, Rambo, Fameuse, Melon, Red Canada, Peck's Pleasant, Swaar, Primate, Spitzenburg, and Northern Spy—raise a few apples for their quality, even if the yield is light. Plant largely of the Greening, Twenty-ounce, Wine Apple, Gravenstein, Peck's Pleasant, Wagener, Tolman's Sweeting, and Dutch Pippin; but the larger share should be the Russet, Baldwin, and, where they do well, the Northern Spy.

ABORTION IN COWS.

The report of Dr. J. C. Dalton, commissioner of the New York State Agricultural Society for the investigation of abortion in cows, states, that the entire number of sub-reports received was 4,259, from the States of New York, Massachusetts, Connecticut, Rhode Island, New Jersey, Pennsylvania, Ohio, Michigan, Illinois, and Iowa, including 1,577 inspectors' reports on farms personally visited. From all the States named, cases of abortion among cows have been reported; but only in New York and Massachusetts have they been sufficiently numerous to excite general attention. In Pennsylvania they were found in Chester and in Cumberland County, reaching ten per cent. of all the cases of pregnancy reported. In Ohio, Illinois, Michigan, and Iowa, there have been comparatively few cases. In New York information has been received from forty counties, reporting 49,749 cases of pregnancy, from May 1, 1866, to May 1, 1867, and 2,574 abortions—a little over five per cent. The malady is not generally prevalent in an active form, even in New York. In ten counties there was not a single abortion among 641 cases of pregnancy. In twenty counties, reporting 19,804 cases of pregnancy, and 661 abortions, the percentage of abortions for each county varied from five to less than one per cent.; and in the remaining ten counties, reporting 29,304 pregnancies and 1,913 abortions, the percentage varied from above five to ten per cent. There were only five counties in which the proportion of abortions was above seven per cent., viz.: Queens, seven and a half per cent.; Clinton, eight per cent.; Orange and Madison, nine per cent.; and Lewis, ten per cent. In Oneida, Otsego, Herkimer, Lewis, and St. Lawrence abortions have occurred, in small numbers, as far back as 1852. In 1860–'61 the number showed a marked increase, amounting to 251, which has been rapidly increased until in 1866–'67 the number was 2,214.

The results obtained by the commission, so far as it has been able to extend the investigation, may be summed up as follows:

1. Abortion exists as a serious malady in some parts of New York and Massachusetts, and in one or two localities in Pennsylvania. It is very rare, or entirely absent, in Ohio, Illinois, Michigan, and Iowa.

2. In New York the annual number of abortions among cattle has considerably increased since 1860–'61. At present the number of abortions for the entire State is about five per cent. of the whole number of cows with calf.

3. The prevalence of abortion is not proportionate to the relative extent of butter and cheese production in the afflicted districts.

4. It is not more prevalent among good milkers than among ordinary milkers.

5. It is not more common in first pregnancies than in subsequent ones.

6. It happens most frequently in the sixth, the seventh, or the eighth month of pregnancy, and in the month of December, January, or February.

7. In all probability it is not due to exposure to cold, or to insufficient stabling of any kind.

8. It is not more prevalent among cows impregnated at the age of one year or eighteen months than among those impregnated at a later period.

9. It is more frequent among cows which have been impregnated by two or three year old bulls than among those impregnated by yearling bulls.

10. It is not due to inflammation of the uterus, nor to any marked change in the generative organs except a stoppage of the circulation and an arrest of development.

11. It is probably not owing to any defect in the original form of the fœtus.

12. Aborting cows are more liable to miscarry the following year than those which have never been affected.

13. The early separation of the calf from the cow does not seem to have any injurious influence in producing subsequent abortions.

14. Abortion is a disease which is extremely local in character, and confined for the most part to particular farms.

15. The large majority of farms, even in the affected districts, are free from the disease, while upon a few farms the percentage of abortion is high, and the disease destructive in its effects.

16. Farms affected, and those unaffected, often lie in close proximity, with no marked difference in physical situation, or in the treatment which the cattle receive, to account for the difference in the prevalence of abortion.

17. It is probable that abortion is, in many instances, imported into the affected farm by cows, purchased while with calf, coming from infected districts, or even from localities where the disease is not known to exist.

THE HISTORY OF THE PLOW.

In a very elaborate report on plows and plowing, occupying about two hundred and seventy pages of the volume, J. Stanton Gould, the chairman of the committee, traces the use of the plow, in agricultural operations, back to a very remote antiquity, and notes in detail the progress and improvements in this implement up to the present day. The Book of Job, the most ancient writing of the Old Testament, begins with an allusion to the plow, and Mr. Gould gives copies of sculptures on ancient monuments which date back four thousand years. It is strange, in view of the antiquity and importance of the plow, that its construction should have received so little attention from scientific men, and the principles upon which it acts should have been so little observed by those who habitually use it. The only special treatise upon it known to us is the work of Small, published late in the last century, and even that gives very little of its history or its theory, being mainly devoted to practical details.

The report states that there are 423 establishments in the United States for the manufacture of plows, harrows, and cultivators, the annual products of which reach a total value of $2,855,248, and about two-thirds of this amount are for plows, in number about 185,500, for

domestic use. The annual export of plows is estimated to reach in value $300,000, which might easily be increased ten-fold. The plowing of the land under cultivation in the United States, estimated at 80,000,000 acres, requires, according to estimate, the labor of 1,000,000 teams, either of oxen, mules, or horses, for 80 days in the year; and the average value of the labor of the men and teams required for this purpose is reckoned at not less than $2 50 per day for each plow, making the aggregate cost of the plowing, each year, to be $200,000,000. It is shown in the report that there is a difference of power, required to perform the same amount of work by different plows, amounting to forty-six per cent., as shown by careful trials in England; and to forty-two per cent., according to the trials instituted by this society in 1850. It follows from this that, if the plow having the lightest draught were brought into universal use, to the exclusion of those which require a greater power, it would reduce the cost of plowing in the United States forty-two per cent.; or from $200,000,000 to $116,000,000, leaving $84,000,000 in the pockets of the farmers; or, if the same number of men and teams be employed, they would be enabled to increase the cultivated area forty-two per cent.* with the same expenditure of power. The annual value of the crops produced in the United States is estimated at about $900,-000,000, or $11 25 per acre. If, by the use of better plows, this amount can be increased forty-two per cent., the aggregate increase would be $378,000,000. It is not claimed that the preceding figures would represent the actual increase of the annual value of the products of agriculture; but, allowing the reader to make necessary deductions for increased cost of cultivation of the increased area for seed, planting, &c., it will be seen that the use of the best form of the plow will increase the aggregate profits of agriculture to an extent equal to the annual national internal taxation of the United States.

The report then proceeds to give the history of the plow; the objects to be accomplished by plowing; discusses some of the practical questions in connection with plows and plowing; the line of draught in plows, and the mechanical condition of the plow; concluding with the awards of the judges appointed by the State Agricultural Society of New York to examine plows, cultivators, and harrows, at the grand trial at Utica, September 10, 1867.

The report states that Thomas Jefferson, ex-president of the United States, was one of the earliest American laborers in the effort to perfect and simplify the plow, his first ideas upon the subject being noted in his journal of 1788, though it was not until 1793 that he reduced his theory to practice. The next American inventor who set himself to work to improve the plow was Charles Newbold, of Burlington county, New Jersey, who invented the first cast-iron plow ever made in America, which was patented in June, 1797. After spending upward of $30,000 in perfecting and introducing the plow, he abandoned the business in despair, the farmers imbibing the notion that the cast-iron plows poisoned the land, injuring its fertility, and promoting the growth of weeds. The next plow patented was by John Denver, of Maryland, June 12, 1804. In April, 1807, a patent was granted to David Peacock, of New

* If $84,000,000 are saved upon an expenditure of $116,000,000, and employed in extending the area plowed, such increase of tilled acreage would be seventy-two per cent. instead of forty-two, and the increase of production would be in the same proportion. The loss, calculated upon $200,000,000, would be forty-two per cent.; the gain, in the event proposed, calculated upon an expenditure of $116,000,000, would be seventy-two per cent. But the calculation has serious fallacy in it, being based upon the assumption that all our plows in use are no better than the worst tested samples of the New York Exhibition.—Ed.

Jersey; February 24, 1808, to Hezekiah Harris, of Kentucky; and the next to Richard B. Chenoweth, of Maryland. Patents were subsequently issued in the following order: to John Klay, of Maryland, January 11, 1812; Roswell Towsley, of Scipio, New York, January 11, 1812; Matthew Patrick, of New York, January 2, 1813; John Seltz, of Pennsylvania, February 8, 1813; Horace Pease, of Scipio, New York, August 28, 1813; Jethro Wood, of Scipio, New York, July 1, 1814; John Swan, of Scipio, New York, July 5, 1814; J. Morgan and J. B. Harris, October 11, 1814; David Peacock, of New Jersey, May 29, 1817; Jethro Wood, September 1, 1817; Edwin A. Stevens, New Jersey, 1817; Gideon Davis, Maryland, May 26, 1818. After this date the inventors of plows multiplied so rapidly that only such inventions are named as involved new ideas, or those which have been remarkably popular, to wit: Zadock Harris, of New York, March 17, 1819; Henry Burden, in 1819; the Hingham self-holding plow, of Massachusetts, about 1823; David Hitchcock, of New York, July 16, 1823; Joel Nourse, of Massachusetts, about 1827; the McCormick plow; John Means, in 1831; David Prouty, in 1831; James Jacobs, July 8, 1834; the Peekskill plows, in 1835; Daniel Webster, in 1836–'37; Samuel Witherow and David Price, Pennsylvania, in 1839; Cyrus Alger, of Boston, in 1839; F. D. Burrall, of New York, in 1843; Governor Holbrook, of Vermont, in 1845; Samuel A. Knox, of Massachusetts, in 1852; H. M. Platt, in 1858; Mr. Mead, of Connecticut, in 1863; Dr. Grant's new plough for deep tillage.

The first idea of the plow was a crooked stick, of which various forms were in use. Then came the provision of an iron point to the plow. Up to this time the crooked sticks used were on the principle of the double mold-board; they threw off the earth on each side. The next step was to hew off one side of the stick, so as to throw out the earth only on one side, approximating to a single mold-board. Then the plow became a simple wedge, the land side being nearly parallel with the line of the plow's motion, the other moving the furrow still to the right, but leaving the furrow standing on edge. Then the wedge was gradually twisted so as to regularly invert the furrow. Jefferson and Small discovered the importance of straight lines, running from the sole to the top of the share and mold-board. Colonel Pickering was the first to discover the importance of a straight line running from the front to the rear. Jethro Wood discovered that all the lines running from front to rear should be straight. Mr. Knox first discovered a method of laying down all the lines of a plow on a plane surface. John Mears first discovered the importance of a center draught, and pointed out the practical means of obtaining it by the inclination of the land side inward. Aaron Smith was the first to adapt two plows to work well together, one of which threw two or three inches of the surface into the bottom of the preceding furrow, and the other covered it with the lower earth. Finally, Governor Holbrook has invented a method by which plows of any size may be made symmetrical, either convex or concave, in such a way as to insure the complete pulverization of the soil.

MICHIGAN.

MICHIGAN STATE AGRICULTURAL COLLEGE.

The secretary of the State Board of Agriculture, Sanford Howard, reports that this institution has been comparatively prosperous during the year, though the accommodations have not been equal to the demands of students for admission, the limited appropriation affording no

surplus above the current expenses for the erection of additional buildings, while the revenue of the college from the sale of swamp lands has been sufficient only to relieve the more pressing wants of the institution in repairs, shelter for stock, greenhouse, &c. The products of the farm were $4,874 72; expenditures, $5,096 23; and of the horticultural department, $1,067 12; expenditures, $1,517 12—the excess of the latter being incurred for orchards, nurseries, &c.

THE MICHIGAN STATE AGRICULTURAL SOCIETY.

This society is reported to be in a flourishing condition, and acting in harmony with the State Board of Agriculture and the State Agricultural College. The total available funds of the society, January 1, 1867, were $12,067 37; receipts during the year, $23,778 90—total, $35,846 36; expenditures, $28,575 56; balance on hand, $7,270 80, which, added to value of buildings and fixtures on fair grounds, $13,407 24, makes the total assets, January 1, 1868, $20,678 04. The premium list of 1867 reached $7,467 75, and the number of entries made at the State Fair 2,166—the largest since 1859.

NECESSITY FOR IMPROVED CULTURE.

The secretary of the society, R. F. Johnstone, urges the importance of greater attention to means which shall induce inquiry and investigation relative to the improvement of farm lands, and stimulate higher cultivation generally. He says that when the attention of the farming community has been addressed almost entirely to the improvement and cultivation of the surface, it has become evident that the improvement and amelioration of both surface and subsoil must hereafter become a necessary part of the business of the farmer, and the question is suggested: "Is it not the duty of the society to devise means and ways by which it can promote a more thorough and perfect system of treatment of land than now prevails?" The premiums offered on farms have already done something in this direction, and the example has been followed with remarkable success by some of the county societies. The holding of farmers' State conventions is recommended as another means of awakening a more general interest in the necessity for an improved system of culture.

PREMIUM FARMS.

The committee on farms, in reporting the awards made, remark that, up to the present time, the general system of agriculture in Michigan has been largely governed by the necessity which has compelled each farmer to apply all his abilities to the clearing and amelioration of the surface of his land. The greater the surface he could till, the more his returns. But the time has come when this system must be changed, the necessity for which is indicated by the decreased production of fields longest under cultivation. Farms that formerly produced thirty to forty bushels of the choicest wheat to the acre now seldom yield over twenty to twenty-five, and in many cases the quality is inferior; and where this yield is exceeded, it is upon the new and recently cleared lands, where the soil is yet rich in the elements of fertility with which nature has supplied the surface.

The first premium farm lies in Webster Township, and contains 520 acres, 365 of which are improved. The soil is generally rich loam, intermixed with white clay, known as burr-oak soil. The system of tillage

is to manure each year, at the rate of forty acres of sod land, and to break it up to the depth of eight or nine inches. The field is planted with corn: next year barley is sown, the hoed corn preceding rendering the soil clean, and peculiarly adapting it to this grain. Wheat follows the barley. Wheat and barley are drilled in, two bushels to the acre; but the drilling is done both ways, the drill being gauged to sow a bushel per acre each way. Grass, barley, and corn are plastered, but it is thought that plaster injures wheat. The yield of wheat was twenty-five bushels per acre, and never falls below twenty bushels; barley thirty-five bushels per acre for the past three years. The corn grown is the eight-rowed white flint. Crops average from fifty to seventy-five bushels. Wheat, barley, and wool are the leading money products. Total productions $6,394; family support, labor, expenses, &c., $3,010. The product of the farm averages $17 50 per acre of improved land, or $9 25 per acre net income.

The second premium farm lies in the town of Avon, contains 340 acres, 275 improved; soil medium light sand, with a large tract of bottom-land, resting on a somewhat compact gravelly subsoil. The practice on this farm is to break up to the depth of seven or eight inches; the land is seeded to clover, the manure from the barn having been drawn out as fast as made, the amount thus applied being equal to ten loads per acre. The field is planted with corn, which yields thirty-five to forty bushels per acre. The next year either oats or barley is grown, the former preferred, and yielding thirty bushels per acre. Wheat follows, the stubble being plowed under, and this crop yields an average of twelve bushels per acre. After wheat the field is seeded to clover, intermixed with timothy. This farm has derived much benefit from liberal manuring and plowing under heavy crops of clover. The wheat crop was increased from nine to an average of twelve bushels per acre by plowing under a crop of Hungarian grass just previous to the sowing of the wheat in the fall. Wheat and corn are the heaviest money crops. Total products $4,069 99, or an average of $14 80 per acre; expenditures, including family support, &c., $1,764 70, leaving a balance of $2,395 29, or a net dividend of $8 40 per acre.

A medal was awarded to a farm of 200 acres, 170 improved, situated in Richfield. The soil of this farm is clayey, with a mixture of gravelly loam. The system of tillage is to plow and cultivate sod ground and plant with corn, followed by oats. The field then lies from three to five years in grass before it is summer-fallowed for wheat. The wheat is then seeded, and it is allowed to lie till it is ready to take up for corn. There is no regular rotation. This system has been adopted as the best for clearing the surface of a heavy-timbered farm. During the past year there were twenty-four acres in corn, fifteen in oats, seven in spring wheat, and four in winter wheat; the remainder, one hundred and twenty acres, was in grass, of which forty-five acres were mowed for hay. Total productions, including consumption of family, $3,373 90, or $19 25 per acre; expenses, including support of family, $1,190 85, or $7 per acre. Surplus, $2,183 05, or a net product of $12 25 per acre.

DRAINAGE.

The committee on drainage give the the following practical illustration of the advantages of this system of reclaiming lands: The lands subjected to drainage consisted of twenty-five acres of swales, productive of the coarsest vegetation, viz: bog grass, flags, rushes, and other worthless rubbish. About eight hundred yards of tile were laid, at an

aggregate expense of $480. The grass products of the field the first year reached $1.570. Expenses, $541 25; drainage, $480—$1.021 25; leaving a net profit the first year of $548 75. Second year, products $1.425; xpenses, $550—net profit $975. These returns are from land yielding nothing before drainage.

ORCHARDS.

The premium on apple orchards was awarded to a three-acre orchard at Ypsilanti, on the south bank of the Huron River, at an elevation of seventy-five to eighty feet above its surface; soil, a sandy loam; oak openings. In 1846 one hundred and twenty trees were set, thirty feet apart, at right angles, embracing ten Baldwins, ten Spitzenburgs, eight Greenings, eight Green Newtown Pippins, six Winter Swaars, eight Winter Pearmains, six Fall Pippins, and four each of Golden Russet, New York Pippin, Twenty-ounce Pippin, Black Gilliflower and Red Gilliflower, Pennock's Red Winter, Seek-no-further, and Vandevere; the remainder choice summer apples. Two trees were lost the first year, and two the second, which were replaced with the Northern Spy. The ground was manured in the spring of 1846, twenty loads to the acre, and a good crop of corn raised. The next year sown to wheat, and seeded to clover, remaining in this condition four years, and kept most of the time for pasture. In 1851 it was again manured and planted with corn, raising a better crop than the previous one. Next year it was sown with wheat and seeded down, in which condition it remained ten years, hay being taken off but twice during the time, and kept for pasture the remainder of the time, being top-dressed with twenty loads of barn-yard manure at intervals of three or four years. The trees were large when set out, and commenced bearing fruit the fourth year, and have steadily increased up to the present time. The cold winter of 1855-'56 killed three Baldwins and two Pearmains. In 1858 the following varieties were cut off and grafted: all the summer apples except six, and Pennock's Red Winter, Twenty-ounce Pippin, Black Gilliflower and Red Gilliflower, Winter Pearmain, and Vandevere; and grafts were set of the following: Steele's Red Winter, Baldwin, Spitzenburg, Northern Spy, King Apple, and Greening, and all did well except those grafted on the Winter Pearmain.

In setting out an orchard, the owner of the foregoing recommends that trees be grown at home, the nearer to the prospective orchard the better. Soil and climate are essential elements in growing trees, and a similarity in these important agencies should always exist between the place where the young trees were propagated and that where they are to be set in the orchard. He thinks top-dressing with barn-yard manure the only reliable course in keeping up the proper standard of fertility to produce a crop of fruit of good quality, and the less the ground is plowed after the trees are matured the better for them. Young fibrous roots run in every direction, and approach the surface in search of food, which the plow destroys.

TREADWELL, DEIHL, AND SOULE WHEAT

The causes of the deficiency in the wheat crop of Michigan for 1867 are stated by the secretary of the Board of Agriculture to have been the midge, the Hessian fly, and winter-killing, much the greater portion being chargeable to the first-named insect. The wheat crop of the State has been seriously diminished by the ravages of this insect in previous years, and it is known that some varieties of wheat have suffered more

than others from its attacks. The Soule wheat seems especially liable to injury from this cause, and it becomes a question whether the cultivation of this variety should be continued. The Treadwell and the Deihl were substituted with advantage the preceding year, being comparatively little injured by the midge, and generally yielded well. Of these two varieties, the Treadwell is represented to be the more hardy, and better adapted to ground not thoroughly prepared; while the Deihl is a somewhat whiter grain, and under favorable circumstances will yield as well as the former. Several instances are reported where the Treadwell wheat yielded twenty-five to thirty bushels to the acre, being nearly exempt from injury by the midge, though the Soule wheat, growing in close proximity, was nearly ruined by that insect, and the opinion is expressed that, had the Treadwell and the Deihl variety been sown instead of the Soule, the result would have been millions of dollars to the advantage of the farmers of Michigan.

SORGHUM IN MICHIGAN.

At the annual meeting of the Sugar-Growers' Association, it was generally concluded that the Otaheitan variety is the best for sugar, and the Chinese variety for sirup; that the best method for the cultivation of the plant is sufficiently known to insure a crop; that the most economical and the safest methods of harvesting the cane, and of caring for it when harvested, are now so well known that the valuable properties of this plant need not suffer deterioration from handling in an improper manner; that the best and safest treatment of the cane, and of the expressed juice when at the mill, does not seem to be definitely settled, the practice in this respect being not generally the same among cultivators and manufacturers, and more thorough examination is requisite in this direction; that the rapid boiling of the purified juice in shallow pans, affording a very full exposure of the sirup to the atmosphere while boiling and cooling, promotes speedy granulation under ordinarily skillful management; that the sirup, when skillfully treated, will readily granulate and furnish a sugar of high, dry quality, without the introduction of foreign sugars; that the quality of the sugar, as to strength or weakness, is determined by the skillfulness of the grower and manufacturer; and that the crop can be grown for sugar, and the production be sufficient in quantity to insure abundant profits, if treated according to the best methods known.

The interest in the sorghum crop is represented as having been steadily on the increase in Michigan, though the season of 1867 was the most unfavorable one known since the introduction of the plant. The yield in the State was estimated at 400,000 gallons, or about half the yield of the preceding year, the cane having been harvested in an immature state and the yield of sirup of course diminished. The quality of the sirup is said to be improving annually.

CHEESE-MAKING IN MICHIGAN.

The business of cheese-making by the factory system has rapidly increased within a year or two in this State, and nearly enough was manufactured in 1867 to supply the demand for home consumption, and there is promise of a surplus for export in 1868. One factory, at Fairfield, received during the season 2,051,625 pounds of milk from an average of 470 cows, being an average of 4,370 pounds of milk to each cow, making 460 pounds of cured cheese per cow, which nets 12 cents per pound, or

$55 20 per cow. The whey was fed to hogs at the factory, netting the patrons about $1 per cow. It takes 8.7 pounds of milk to make one of green cheese, and 9½ pounds for one pound of cured cheese. The rule is to make cheese for patrons at 1½ cent per pound and the whey, or 1¾ cent per pound and feed the whey to patrons' hogs.

Skim-milk cheese.—It is claimed that the most palatable cheese is not necessarily that which is richest in butter; that American cheese is richer in butter than it need be, and that the butter cannot be retained in the curds; that the price of butter is greatly in excess of that of cheese, and that, in consequence, we are annually throwing away millions of dollars—a loss which, it is said, may be remedied by the establishment of butter factories in connection with cheese manufacture. With a view to this economy, a combined establishment has been started at Ceresco, Michigan. Operations commenced with 45 cows, gradually increased to 85, and the whole amount of milk received during the season was 563,238 pounds; amount of butter made, 17,318 pounds; cured cheese, 42,514 pounds. The butter sold for a little over 30 cents per pound, and the cheese at 14 cents. The quality of this skim-milk cheese is stated by Professor Kedzie to be as good as the average of country-made cheese manufactured from whole milk, and contains three times as much butter as does the English skim-milk cheese, and only four per cent. less than the "Double Gloucester," which is made by adding the milk and cream of the evening to the fresh milk of the morning. The famous Cheddar cheese, also, contains only 12½ per cent. more of butter than does this American skim-milk cheese.

Causes of bad flavor of American cheese.—Mr. Weeks, secretary of the American Dairymen's Association, in a paper read before the annual meeting, held at Utica, gives the following as the most serious causes of the bad flavor of American factory cheese: 1. Unclean milk. 2. Diseased milk. 3. Cows eating objectionable weeds, imparting bad flavor to the milk, and thence to the cheese. 4. Cows being chased by dogs, or otherwise overdriven, rendering the milk feverish and unnatural. 5. Failure to remove natural heat from the milk. 6. Impure annotto. 7. Bad rennets. 8. Curds insufficiently cooked, which in our warm climate will almost invariably lose their sweet flavor. 9. Curds too lightly salted. 10. Salting curds while too warm and too damp. 11. Putting curds into the hoops and to press before they are properly cooled. 12. Exposure of cheese to too high a temperature while curing. There are other things also which induce bad flavor, as foul cows and milking utensils, tainted pails and unclean surroundings of the factory, all of which have their influence, and a most injurious influence it is.

THE POTATO BUG.

James Bernard states that he has learned how to manage the potato bug (*Doryphora decem-lineata.*) He observed that in one patch of potatoes several rows were nearly stripped of their leaves, while the other rows in the same patch were scarcely touched. These rows were of different varieties, and he thinks the insects have a preference, and will devour one variety before commencing on others. His plan is to plant first such varieties as the insects like best, which will attract the beetles when coming from their winter sleep; and then to plant his other varieties, and, as the beetles will not leave their first location while there is anything left to eat, the later-planted kinds will grow out of their way before being molested. Illustrating this theory, one patch on Mr. Bernard's farm was completely stripped, the foliage and stalks being literally devoured, while

those planted later were uninjured. It is probable that any variety planted quite early will answer equally well, as the beetles, when once located, are not inclined to remove far, either from sluggishness or devotion to their young, and will continue to devour the stalk down to the tubers, eating holes into the latter; while another patch, not thirty rods distant, may remain untouched.

BUYING AND SELLING WOOL.

At the Michigan State Agricultural Convention, the following rules, governing sales of wool, were adopted: 1. Sheep should not be allowed access to straw stacks, especially of barley or bearded wheat. 2. All sheep, except perhaps bucks, should be well washed if practicable in a running stream, and as early in the spring as the weather will permit. 3. Sheep should be sheared, weather and other circumstances permitting, within six to ten days after washing. 4. At the time of shearing the fleeces should be carefully rolled up, without being too tightly pressed, wound with light-colored, strong twine, put twice each way round the fleece, carefully excluding all dead wool and unwashed tags. 5. Reasonable deductions should be made on account of unwashed or otherwise unmerchantable condition—this deduction to be determined, however, according to the condition and quality in each case, and not by any arbitrary rule of deduction, to be applied indiscriminately to all cases.

IRRIGATION.

In a lecture upon this subject Professor Coleman gives an account of the practice of irrigation on a farm at Brattleboro', Vermont. The farm is situated on a high hill, near the summit of which is a basin comprising several acres, formerly a boggy swamp, and the source of a small stream running through the fields below. By making a dam of a few feet in height along the lower edge of the swamp, a reservoir is formed, which holds a large quantity of water. From this reservoir water can be taken over the greater part of the farm, and might be carried over portions of adjoining farms. About seventy acres are irrigated, though the water is not let on the whole tract every year, irrigation being practiced only with the grass crop. The water, soon after leaving the reservoir, is divided into several main channels, by which it is carried to different fields, where it is made to flow in thin sheets over the grass. The water is let on in the spring before the snow is gone, the effect of which is to melt the snow next the ground, making a space between the snow and the grass. The water thaws the ground, and the heat thus imparted starts the grass, so that, by the time the fields are bare, they become beautifully green. The water is kept running on the grass till about two weeks before haying. It does not run constantly on the same ground, but as required. As soon as the first crop of grass has been cut, the water is flushed over the ground, and the gray stubble is soon hidden by a luxuriant second growth. Most of the irrigated lands produce one and a half to two tons of hay per acre the first cutting, with an after-growth of a half to three-quarters of a ton. Water should not be let on the meadow very early, if the ground is bare, lest the grass be destroyed by freezing. It has been demonstrated here that land may be kept in grass permanently by irrigation, with increasing fertility and productiveness.

In the discussion which followed Professor Coleman's lecture, it was

said that the trampling of sheep did much to benefit clover, by consolidating the land, just as the old agriculturists had found their clover best on the headlands which had been trampled by horses.

BONE-DUST AND SUPERPHOSPHATE OF LIME.

A committee of the Calhoun County Agricultural Society report upon the value of these fertilizers, recommending them as requisite in restoring to the soil properties exhausted under the system of cropping generally practiced in the wheat-growing States. An analysis of the grain of wheat, that part of the plant which is not again returned to the soil, shows that nearly fifty per cent. of the ash constituent is phosphoric acid, and this is equally true of nearly all the cereal crops. When it is considered that our most fertile soils contain a very small percentage of this essential element, and that in many soils there is scarcely a trace, its real importance in an agricultural point of view cannot be questioned. Under our system of cropping, the mineral elements first exhausted are the phosphates, and, while conceding that no special manure can be regarded as a substitute for barn-yard manure, the question arises, can the farm be made to sustain its productiveness by the use of manures made solely from the products of the farm? Every bushel of grain and roots, every pound of cheese, butter, and wool, every ton of hay and straw sold, carries away a portion of the organic mineral elements of the soil; and, if something is not added to supply this deficiency beyond the ordinary accumulations of the barn-yard, gradual but certain deterioration of the soil must necessarily follow. The largely increased yield of wheat by the use of clover and plaster on fields partially exhausted by tillage, the clover being plowed under as a green crop, has led some to suppose that nothing else is needed to retain or restore the fertility of their land. Without doubt there are important benefits derived from the use of clover and plaster as fertilizers; indeed a soil may have an available supply of minerals for a wheat crop of forty bushels per acre, but, if deficient in ammonia, the crop depending solely upon the atmosphere for its supply, the yield will not exceed eighteen or twenty bushels, under the most favorable circumstances of weather, ammonial manures being necessary to increase the yield. Yet, valuable as is the clover crop in furnishing this essential organic matter to the cereal crop, it adds no mineral matter to the soil. The clover crop and the ordinary accumulations of the barn-yard are not sufficient to restore the mineral elements of which the soil is deprived by successive grain crops, and it is necessary to resort to other fertilizers to restore this deficiency.

The phosphates, among the mineral elements, necessarily first disappearing on a wheat farm, the value of bone-dust and the superphosphates cannot be questioned, the former containing about fifty per cent. of phosphoric acid. But it will not do to rely upon this alone, as will be apparent when the constituents of bone-dust are considered. One hundred pounds of raw bones may be estimated to contain 11 pounds water, 45 pounds phosphate of lime, 38 pounds fat and gelatine, of which about five pounds are nitrogen; of the phosphates about fifty per cent. are phosphoric acid. If all the nitrogen is preserved, 100 pounds of bones would furnish the amount expended in growing a bushel of wheat; an application of 400 pounds per acre would furnish only 20 pounds of nitrogen, about one-third the quantity contained in the clover, equaling one ton of dry hay. The committee think that, in connection with a proper use of clover as an organic fertilizer, the wheat crop may be largely and profitably increased on impoverished soils by an application

of 300 to 400 pounds of bone-dust per acre; on soils not greatly impoverished a smaller quantity will answer.

It is sometimes the case that bone-dust, when no other manures are used, fails to materially benefit the wheat crop to which it is immediately applied. This is attributed chiefly to a deficiency of ammonia; and when the wheat crop, under such circumstances, is only slightly benefited, the clover sown the succeeding spring, which obtains a large proportion of its ammonia through its broad leaves from the atmosphere, will be largely increased by the decomposing phosphates applied in the fall, thus accumulating ammonia for the succeeding wheat crop. The failure of bone-dust to benefit the crop to which it is first applied is owing also to its undecomposed condition. In one instance given, 500 pounds per acre was applied to corn without benefit; the second year it helped the corn, and the third year after the application the yield of wheat was four bushels per acre greater than the product of land in the same field not so dressed.

On soils where no phosphates have been applied, an immediate fertilizer being needed for a summer crop, a well-prepared superphosphate is recommended as preferable to undecomposed phosphate. The effects of a properly-prepared superphosphate upon a turnip crop are frequently almost magical, the crop being increased four or five fold by an application of 400 to 500 pounds per acre. When used for wheat and clover it should be well mixed with the surface soil, in a partially fermented condition, before the wheat is sown. Ample time will thus be given for a portion of the phosphates to be decomposed, and taken up in solution by the roots and plants, and organized in the grain. After the wheat crop has matured, the clover sown in the spring will be still further benefited by the gradual decomposition. Ashes, both leached and unleached, are highly valuable as additional fertilizers in furnishing potash and other minerals for the cultivated crops. In closing their report the committee state that, under the system of cropping so widely prevalent, the most careful preparation and use of all the available bones in Michigan will not replace the phosphates withdrawn from the soil by the frequent recurrence of the wheat crop; and that, to increase the productiveness of their lands, farmers must lessen the proportion of acres annually devoted to wheat, keep more stock, and thus manure more highly from the products of the farm, and with other valuable fertilizers at command.

AGRICULTURAL SOCIETIES—THEIR OBJECTS AND MANAGEMENT.

An article upon this subject states that the Highland Society of Scotland—the oldest in Great Britain—was formed in 1780, and that the first steps toward such organizations in this country were taken shortly after the close of the Revolution. "The Philadelphia Society for the Improvement of Agriculture" was organized in 1787, numbering among its members George Washington, Robert Morris, Timothy Pickering, and other distinguished men. "The Massachusetts Society for the Promotion of Agriculture" was formed in 1792, with Samuel Adams as president. "The New York State Society for the Promotion of Agriculture, Arts, and Manufactures" was organized in 1793, with Chancellor Livingston at its head. County societies—Berkshire, Massachusetts, taking the lead—were formed in several States before the close of the last century, but it was not until after the war of 1812 that these societies became general. Before the establishment of exhibitions, societies directed their efforts mainly to bringing out papers or essays in response to questions propounded, much valuable matter being thus elicited.

Some societies offered premiums for the introduction of specimens of breeds of domestic animals, implements, seeds, &c., thought to be desirable; and, under this offer, Merino, Leicester, and Texel sheep, and both Shorthorn and Holstein cattle were introduced into Massachusetts. Premiums were also offered for experiments. The fundamental idea in the institution of agricultural societies was to better the condition of the farming class, by introducing such improvements in husbandry as would secure the best returns for the outlay of labor and capital. Affording amusement to the people, any further than amusement could be derived from objects of actual utility, was not contemplated, and this is undoubtedly the true groundwork for such associations.

The means by which agricultural societies can effect improvement are enumerated as follows: 1. The holding of exhibitions at which premiums are given for specimens of superior merit or excellence in the different departments to which their supervision is extended. 2. The bestowment of money for making experiments to settle doubtful questions. 3. The publication of special papers or essays, comprising useful information. Of these the holding of exhibitions is the most prominent, but not necessarily the most important, though many societies make this the sole object. Judgment is required in the offering of premiums, and generally the amount of premium should be graduated by the utility of the object for which it is offered. It is important to establish correct standards by which animals and things should be judged. The mere use of the word *best* does not express anything as to what constitutes excellence.

Unusual prominence has of late years been given to the horse, and, under the name of "trials of speed," some societies have made racing the principal feature of their exhibitions. The excitement incident to these displays is attractive to those who attend for amusement; but is there any real improvement effected by these premiums? What improvement do they make or even intend? It frequently happens that the winning horse is one of little value for any purpose of usefulness, and the offering of premiums for mere speed, if it has any effect at all, tends to the production of horses in which the more useful properties are found only in an inferior degree. An acquaintance with the manner in which these "trials of speed" are got up leads to the conclusion that they are chiefly designed as means for making money for hotel-keepers, horse-dealers, and gamblers; and the contests are, in principle, nothing more than those instituted by gambling associations, where horses compete for purses. In view of these facts, are such displays calculated to improve either the breed of horses or the morals of men? The true friends of agriculture are disgusted and stand aloof, thus depriving the societies of the aid of the most substantial citizens, the class which can alone be depended upon for the prosecution of enterprises designed for the public good. The horse need not be excluded from these exhibitions; he is one of the most useful of our domestic animals, and his improvement should not be overlooked. Several classes of horses are required, however, the most important of which, in this community, is the farm horse; and this also is the class most needing improvement. Next in importance is the roadster. One point of merit in this class is, of course, speed; but the fairest mode of testing the quality would be to try each horse by himself in a quiet way; for, when put upon the track in competition, the race is not always to the swift, the tricks of the jockies often having more to do with the result than the speed of the horses.

It is said that the people will not attend purely utilitarian exhibitions, but experience shows that this objection is not valid. The New York State Agricultural Society has form the beginning steadily refused

to tolerate any gambling or clap-trap expedients. It has never allowed trials of speed on its grounds, and has never set apart any more ground for horses than was required fairly to show their gait; yet large crowds have always attended the exhibitions of this society. In Great Britain everything that has not a direct bearing on the improvement of agriculture is rigidly excluded from the exhibitions; yet the people attend in as great numbers, in proportion to population, as they do in this country. At the exhibitions of our Canadian neighbors they have no trials of speed, and allow no private shows upon their grounds; but their exhibitions are as well attended as ours. It is unreasonable to suppose that our people are naturally so different from those of other countries that they cannot be influenced by similar motives.

The subject of trotting and racing horses at agricultural exhibitions seems at last to be attracting considerable attention from persons who have the prosperity of agricultural societies at heart. W. L. Webber, in his address before the Saginaw County Agricultural Society, observed that, "While an agricultural society, conducted as it should be, is productive of manifest good, experience has proved that a society under the name and guise of agriculture may, by mismangement, and by its officers mistaking or forgetting the objects for which the society was formed, become rather an evil than a blessing to the community." It is apparent that the "fast-horse business" is operating injuriously on the interests of agricultural societies. The meager display of animals and articles in general at exhibitions is attributable to the fact that the public interest is absorbed by the racing allowed on these occasions; and it is thought by many that, unless this thing is checked, it will ruin the societies.

The utility of exhibitions depends very much upon the systematic transaction of business. There is usually too much hurry and confusion, which might be avoided in a great degree by requiring the entries to be made in advance. It is advisable also that at large shows, at least, the awards be made before the crowd is admitted. The offering of premiums for the settlement of doubtful questions, under proper direction, may accomplish much good; and it should be a leading object to do that which cannot be done by individuals. Accurate experiments are always valuable to agriculturists in general, but in most cases cause loss to their conductors; hence the peculiar propriety of encouraging experiments by premiums. Every zealous farmer is an experimenter, but the results of his experiments are seldom known to others. To prove that a doubtful practice is wrong would be as valuable to agriculture as to prove it right; but the proof may be obtained fifty times by as many farmers, and still the result be unknown to all but the experimenters. Premiums for experiments, conducted with care and accuracy, and repeated under different circumstances until the point in question is clearly settled, could not fail greatly to promote the improvement of agriculture. The reports and experiments would comprise useful matter, and, in connection with special papers and essays, would be valuable for publication by the society. If officers of societies would take this matter seriously in hand, they might greatly increase the usefulness of their associations, besides adding largely to the fund of useful information.

OHIO.

REPORT OF THE SECRETARY.

John H. Klippart, corresponding secretary of the State Board of Agriculture, says, in his annual report, that while the past twelve or

fifteen years have witnessed a greater revolution in Ohio in the introduction of mechanical forces into practical agriculture than the most fertile imagination could have conceived at the commencement of the present century, there has been no improvement in the management of soil since 1850; neither the product per acre nor the aggregate yield has been increased. No crop of wheat since 1850 has yielded so many bushels as the product of that year, and no crop since has equaled the yield per acre, while the area in wheat has been regularly decreasing up to the present year. He estimates that the wheat production of the State for the years 1864–'65–'66 fell at least 3,000,000 bushels below the actual home consumption for bread each year after deducting reserve for seed, requiring an importation of that amount annually, instead of exporting 10,000,000 bushels as in former years.

The acreage in corn almost attained its maximum in 1855, when the acreage was 2,205,282 and the yield 87,587,434, against an acreage of 2,182,789 and a yield of 63,865,162 bushels in 1867. But one year's crop has exceeded that of 1855; it was that of 1860, aggregating 91,588,704 bushels on an area of 2,397,639 acres.

The secretary remarks that Ohio cannot maintain her position as an agricultural State, if she fails to produce a sufficient supply of breadstuffs for her own population, and suggests that experiments be instituted with the view of obtaining an increased product per acre, without materially increasing the expense of cultivation.

Horse-hoeing wheat in the spring has proved beneficial in Europe, but so long as Americans undertake to grow two crops at once, wheat and clover, it is not probable that horse-hoeing will find much favor; though it would be much more remunerative to grow forty bushels per acre by horse-hoeing and grow the clover separate, than to grow fifteen or eighteen bushels in connection with a crop of clover.

The aggregate acreage under cultivation in 1867 shows an increase of only about 75,000 acres over that of 1858. The maximum number was reached in 1860, being 7,405,406; in 1863 the amount had fallen to 6,343,494; in 1867 it had again increased to 6,479,659, but nearly a million of acres less than in 1858, while the population had increased half a million.

Products of 1867.—Wheat, 15,220,726 bushels; rye, 1,023,520 bushels; buckwheat, 590,294 bushels; oats, 18,534,772 bushels; barley, 1,604,226 bushels; corn, 63,865,102 bushels; meadow hay, 1,993,463 tons; clover hay, 286,807 tons; clover seed, 147,876 bushels; clover plowed under for manure, 26,827 acres; flax, 10,523,876 pounds of fiber, and 726,517 bushels of seed; potatoes, 5,794,797 bushels; tobacco, 11,589,355 pounds; butter, 34,833,604 pounds; cheese, 19,985,486 pounds; sorghum sirup, 1,255,807 gallons; sorghum sugar, 20,094 pounds; maple sirup, 339,444 gallons; maple sugar, 2,655,881 pounds; grapes, 4,558,707 pounds; wine, 291,933 gallons; grape-vines planted during the year, 3,483 acres; whole number of vines in the State, 6,939 acres; wool, 24,844,601 pounds; sweet potatoes, 11,365 bushels; apples 9,404,642 bushels; peaches, 1,402,849 bushels; pears, 125,702 bushels; pasturage, 4,218,710 acres; number of acres in orchards, 340,925; uncultivated lands, 5,838,906 acres; stone-coal mined, 46,703,886 bushels; pig iron manufactured, 1,887,584 tons.

Farm stock.—Horses, 698,909; cattle, 1,504,558; mules, 25,272; sheep, 7,622,495; hogs, 1,807,594; dogs, 176,807; sheep killed by dogs, 34,141; injured, 19,416; aggregate amount of injury to sheep by dogs, $123,827 54.

THE MADISON COUNTY CATTLE SALES.

The aggregate number of cattle and other stock sold at the monthly sales in Madison County during the year 1867 was 3,713 head, divided as follows: Three-year-old cattle, 643; two-year-old cattle, 1,664; one-year-old cattle, 632; dry and fat cows, 193; milch cows and calves, 46; two-year-old heifers, 21; one-year old heifers, 29; calves, 10; bulls, 3; oxen, 86 yokes; sheep, 236; mules, 23. Average weights and prices for the year: three-year-old cattle, 1,129 pounds; price, \$71 40; two-year-old cattle, 902 pounds; price, \$48 54; one-year-old cattle, 594 pounds; price, \$29 50; dry and fat cows, 972 pounds; price, \$39 74; milch cows and calves, price, \$52 26; two-year-old heifers, 732 pounds; price, \$32 71; one-year-old heifers, 528 pounds; price, \$17 60; calves, price, \$28 75; bulls, 1,200 pounds; price, \$49 25; oxen, 2,704 pounds, per yoke; price, \$186 44; sheep, price, \$2 65; mules, price, \$65. Total cash sales, \$169,582 34, or an average of \$14,131 86 per month.

PREMIUM CROPS REPORTED FROM COUNTY SOCIETIES.

Wheat.—Henry Everett, Van Wert County, raised on two acres of land, 57½ bushels of wheat, at a cost of \$24 12; sowed three bushels of seed.

Samuel Mitchell, of Brown County, raised on one acre 27 bushels 34 pounds, at a cost of \$11 28. Wheat sold at \$3 per bushel—\$82 70; net profit, \$71 42. Variety, Tappahannock; 1½ bushel sown, on tobacco ground.

H. T. Rinehart, of Auglaize County, raised on seven acres 191 bushels 17 pounds, at a cost of \$71 50. Wheat sold at \$2 per bushel—\$382; net profit, \$310 50, or \$45 36 per acre. Corn stubble land, broken in June, stirred in August, and twice harrowed and drilled September 1, putting one bushel of seed to the acre.

Corn.—H. T. Rinehart, of Auglaize County, raised on one acre 81 bushels 6 pounds of corn, worth \$64 86; cost of raising, \$8; net profit, \$56 86. Ground, an old meadow never before plowed; broken up early in spring, so as to freeze after plowing, then harrowed well, and planted 13th May, plowed four times, commencing as soon as the corn was large enough. Another acre yielded 96 bushels of corn. The land was harrowed and rolled until perfectly mellow, furrowed one way and drilled, three or four grains in the hill, two feet apart, and plowed twice, three furrows in a row.

Eleazer Abbe, of Lorain County, raised on one acre eighty-nine and two-fifths bushels of corn. Ground never before plowed; broken up in May, thoroughly harrowed and planted without manure, four feet apart each way; cultivated twice and well hoed.

M. V. Brown, of Brown County, raised on one acre 77 bushels of corn, worth \$57 50; expenses, \$10 25; net profit, \$47 25; soil, a clay loam, plowed in April, eight inches; rows four feet apart each way; seed, small, yellow corn.

H. N. Gillett, of Lawrence County, raised on one acre 99 bushels 12¾ pounds of corn, on a field which had been under cultivation forty-seven years without manure; river bottom; soil one-fifth white oak, sandy, clay loam; balance alluvial, with blue clay subsoil; culture, land broken about a foot deep, harrowed once, and laid off three feet nine inches each way; planted with Gillett's improved corn, worked each way when quite young, with cultivator, hoed once, and thinned to two stalks, plowed twice, and just before the tassel appeared it was worked by running the

cultivator across the furrows of the last plowing, holding up the side of the implement next to the row, so as to barely scarify the surface near the corn.

George Nichols, of Morrow County, raised on one acre 90 bushels, and on five other acres 60½ bushels each of corn. The piece was an old meadow, plowed and harrowed, rowed one way, nearly four feet apart; plowed twice in the row one way, and hoed once. The first acre was a black loam; of the other five, four were black loam, and the remaining one clay; no manure used.

Barley.—A. E. Hoffman, of Van Wert County, raised on one acre 41 bushels of barley, worth $41; expenses, $11; net profit, $30. Land plowed and harrowed, sown broadcast and harrowed, harvested by hand, threshed by machine.

A. P. Rinehart, of Auglaize County, raised on 1½ acre 50 bushels of barley. Clover sod, plowed in July, and fallowed; grain drilled in.

Hay.—A. R. Taylor, of Lorain County, cut from four acres of bottom land 14 tons of timothy. The grass stood three feet to four feet high, and very thick. The land was not pastured the preceding fall, which Mr. T. thinks adds twenty-five per cent. to a meadow, especially if before a dry summer.

Potatoes.—A. E. Hoffman, of Van Wert County, raised on one-fourth of an acre 40½ bushels of potatoes, valued at $40 50; expenses, $11.50. Net profit $29. Land plowed and harrowed. The potatoes were cut and dropped in rows; hoed once, plowed three times.

Hiram Leget, of Morgan County, raised on one-half acre 124 bushels of peach-blow potatoes. Sod ground of sandy character, plowed deep in March and planted 1st April; drilled six inches apart; cultivated twice with double-shovel plow, and hilled up with No. 4 plow, placing the seed deep in the hill.

S. H. Scott, same county, raised on 88 rods 114 bushels white peach-blow potatoes, valued at $114; expenses, $30 40; net profit, $83 60. Corn land, with five loads of manure spread on, and then plowed deep; planted in drills, plowed three times, and hoed once.

H. N. Gillett, of Lawrence County, raised on one acre 160 bushels 15¾ pounds peach-blow potatoes, valued at $160 25; expenses, including interest on land, taxes, &c., $32; net profit, $128 25. Soil, dark clay loam, in places quite gravelly. Planted middle of June, on heavy blue-grass sod recently turned.

Mr. Gillett divided one potato into 179 sets, from which, after sprouting, 67 slips were taken, making in all 246 hills, from which he harvested 10 bushels 48½ pounds, after having 29 hills robbed by thieves. The potato occupied eight rods of ground. Soil, pond-muck; crop worked with hoe after breaking deep with the big plow. No manure used.

Sweet potatoes.—William Meyer, of Brown County, raised on nine rods 23 bushels of Lebanon yellow sweet potatoes, at a cost of about $6. Soil, light loam, without manure; plowed early in the spring, and re-plowed and harrowed middle of May, then thrown up in ridges 3½ feet apart, and dressed over with a hoe; the seed potatoes sprouted in a hot bed, and transplanted 20th of May; plants set in the center of the ridges, 18 inches apart, and watered as set, and afterward plowed twice with double shovel, and hoed twice.

Sorghum.—A. E. Hoffman, of Van Wert County, raised on one-fourth of an acre, Chinese cane, yielding syrup valued at $20 25, at a cost of $12 25; net profit, $8. Land plowed and harrowed, and planted in hills about four feet apart.

MILK, BUTTER, AND CHEESE.

Milk and butter.—R. Baker's cow, "Victoria," 11 years old, three-fourths Shorthorn, gave in ten days, commencing July 9, 610½ pounds of milk. "Ruby," five years old, three-quarters Shorthorn, gave 423 pounds in same time. "Irene," eight years old, seven-eighths Shorthorn, gave, in ten days, from June 14, 18½ pounds of butter. These cows were kept on grass during the trial, and for six weeks previous.

George E. Nichols, of Lorain County, entered his "Star" cow, eight years old, large and fine, as yielding 557¼ pounds of milk in ten days, the highest for one day being 59 pounds.

Cheese.—The premium cheese in Lorain County was made in May and June from 18 cows, two milkings to a cheese, with no addition of cream. After a calf was killed, the rennet was taken out, turned and examined, turned back, filled with salt, hung up and dried. In preparing the rennet it was cut up in small pieces, put in a stone jar or crock, and a gallon of water and one quart of salt added to each rennet, and to each six rennets three lemons and one ounce each of sage, cloves, and cinnamon. The cheese was pressed in a common self-presser for twenty-four hours, and then in a screw-press the same length of time, then put in a drying-room and turned daily.

According to the list given there were 52 cheese and butter factories in the State in 1867, with an aggregate of 37,050 cows, located as follows: Geauga County, 19 factories, 16,350 cows; Lake, four factories, 1,600 cows; Trumbull, three factories, 2,700 cows; Summit, eight factories, 5,050 cows; Portage, six factories, 3,800 cows; Cuyahoga, two factories, 1,500 cows; Lorain, four factories, 2,750 cows; Huron, two factories, 1,200 cows; Ashtabula, one factory, 400 cows; Medina, three factories, 1,700 cows; being an average of 712½ cows to each factory.

SMALL FRUITS.

Charles Van Thorne, of Berlin Heights, raised on 77 rods 100 bushels of strawberries, mostly Wilson's Albany. The vines were covered with straw, thus protecting them from the severity of the winter. One of the committee raised on less than four rods over five bushels of Lawton blackberries, worth in Cleveland \$6 to \$8 per bushel, at the rate of more than \$1,000 per acre.

Nicholas Ohmer, of Dayton, from two acres in strawberries, the Washington, McAvoy Superior, and Wilson's Albany, realized, during seven years, from \$150 to \$200 per acre above expenses of picking, marketing, &c.: from four acres in Black-cap raspberries he netted from \$125 to \$150 per acre annually; and from 1½ acre in Lawton blackberries he had four good crops in seven years, netting an average of \$200 per annum. After planting, the strawberries received no further attention than weeding; from the raspberries the old wood was cut away as soon as the vines had done bearing, and the new wood cut back, leaving the stalk not to exceed three feet in length; the blackberries were several times winter killed, and are somewhat tender in that locality; the only cultivation was cutting away the old wood, one good plowing annually, and keeping down the weeds. His strawberry patch now contains five acres, chiefly Wilson's Albany, some Jucunda, or Knox, Agriculturist, and Russell; the crop of 1867 reached 125 bushels per acre, field culture, from which he realized \$1,900. He finds currants and quinces profitable; gooseberries, cherries, and peaches unprofitable.

FALL PLOWING, HIGH CULTURE, ETC.

Fall plowing for corn.—In an "Agricultural Survey of Delaware County," Thomas C. Jones states, in reference to corn planting, that the best farmers break up clover or clover and timothy sod in the fall or winter, and that great benefits result from the practice. The soil, on account of the ameliorating influence of the winds and frosts of winter, is more mellow and friable, and consequently more fertile. This mellow condition of the soil remains all summer, and may be readily distinguished from lands broken up in the spring. The effect in the destruction of worms is equally important. Some years since a portion of Mr. Jones's sod for corn was not plowed until late in the spring; the remainder of the field had been plowed in the fall. The result was, that the corn upon the late plowing was nearly all taken up by the cut-worms; while that upon the fall-plowed portion was not disturbed, the worms stopping at the very row where the latter commenced.

Plaster for clover.—Of plaster Mr. Jones says that, though used in the county to very limited extent, when applied to clover, the result in every case has been an extraordinary increase in the crops. In his first experiment about 1½ bushel per acre was sowed upon the young clover the latter part of May. A strip was left through the middle of the field without sowing. The difference in the color and quantity of the clover, at the time of mowing, was incredible. The plaster increased the yield at least one-third, and the difference in the aftermath was still more marked, as it was also in the crop of the following year, especially on the timothy, upon which it appeared to have little effect the first year. He tried plaster on wheat and corn in the hill, but could discover no material benefit in either case; but for clover he considers it by far the cheapest fertilizer, and thinks every farmer should make a thorough trial of it, his impression being that there are few soils where it may not be applied with advantage.

High culture.—In concluding his general observations upon farm operations, Mr. Jones remarks, that whatever branch of agriculture a man may engage in, whether mainly in tillage crops, or stock, there can be no profitable results, unless his land is kept in good condition. Large crops are always profitable; small crops are always grown at a loss. The experience of Delaware County farmers has demonstrated that the only practical way to keep their clay lands in good condition is to break them up as deep as possible, eight to ten inches, and in the fall, if practicable, to throw the subsoil up, so that the frost can act upon it. This will loosen it, as will the stirring which it will get in summer in working the corn crop. Then, after carefully saving and applying the barnyard manure, their great dependence must be clover, for the two-fold purpose of enriching the land with its large growth of vegetable matter, and of assisting in the important work of loosening it and keeping it friable, with its far-reaching net work of roots. Air and moisture must penetrate the earth, or crops will not grow. It has been demonstrated that plants will grow with no other food than air and water, but without these the best soil will fail to produce vegetation.

DRAINAGE.

Under the general ditch laws the commissioners of Wood County have granted and laid out 130 drains, averaging ten miles in length; and the several townships have granted and laid out an equal number,

averaging three miles in length. During the summer and fall of 1867 nearly 400 miles of county ditches were made, at an average cost of $1,000 per mile, and about 50 miles of free turnpike roads. One of these county ditches is 30 miles long, from eight to 20 feet on the bottom, and from three to six feet deep, deepening and widening as it approaches the outlet. The county spent, in 1867, about $500,000 for drainage purposes, and it is considered a good investment.

INDIANA.

MILCH COWS.

An essay on breeding cattle and the management of milch cows, by Alfred Hadley, urges the farmer or dairyman to keep good stock, as most prudent and profitable. Counting the cost of keeping a cow the whole year at $3 per month, and estimating the milk at four cents a quart, a cow that cost $60 and averages eight quarts a day for 300 days of the year, will exactly pay first cost and expenses; while a cow that costs $100 and averages 12 quarts, will pay first cost and expenses and $8 over, so that if a good cow is worth $60, a very good one is worth $100, besides the strong probability that the offspring of the very good cow will also be superior. The writer says that the Shorthorn breed varies widely from very good to very poor milkers, and that choosing a heifer for the dairy from this stock is always attended with risk. The Devonshire cows are much nearer uniform. He commenced breeding Shorthorns thirty years ago, but for the past ten years has used the Devons mostly; and has never yet milked one that did not give rich milk, though there is a variation in the quantity and quality even with them. The Shorthorns are not surpassed for growing and fattening, when they have an abundance of good pasture or other good food. He once had a pure Shorthorn calf which at seven months old weighed 700 pounds, and he had only about half the milk his dam gave during the first three months.

In reference to milking, Mr. Hadley says, the pen should be furnished with troughs for salt or meal, and with a large movable box to receive the droppings, and the pen be kept clean. Before milking, the cows should be brushed with a short-handled broom, and their teats washed with cold or warm water, as the weather may indicate. Milk each teat a little as a kind of preparation, after which the faster and sooner the milk is taken, the more milk the cow will have to give the next time, if the milking is not performed rashly. Each cow should have the same location and the same milker, and the milking should be performed regularly before sunrise and after sunset. Neither the cow nor her milker should be interrupted during the process of milking, and the less talk there is in the pen the more milk the cows will give. The teats should often be greased, after milking, with some bland oil; opossum is the best.

DEEP PLOWING.

The same writer in another article advocates deep plowing as necessary, in connection with judicious underdraining and manuring, to stay the general deterioration of farm lands, and restore the natural productiveness of the soil. He sums up the advantages of deep plowing as follows: First. It often prevents growing crops receiving material injury, by inducing a more speedy and general diffusion of a superabundance of rain or water. Second. It receives and holds in store a much

larger amount of plant food, carbonic acid, ammonia and water, and at the same time admits of a proportionally wider range for the roots of plants to travel in pursuit of that food, so that when dry weather comes, plants growing in a deeply pulverized soil will be supplied with food, and sustained in their vigor of growth much longer than plants in a shallow plowed soil. Third. It admits of a much more free and extensive circulation of air, and as the subsoil is much cooler than the air, it acts as a condenser; and, as the air comes in contact with it, it is decomposed and water is left in the soil, richly laden with carbonic acid and ammonia. There is a bountiful supply of water held in solution by the air in the driest weather; and consequently, if the soil could be kept completely pulverized to a sufficient depth, a crop of corn could be produced without rain.

UNDERDRAINING AND GRASSES.

An article upon this subject, by J. F. Soule, holds that the two great needs of Indiana are grass and drainage—systematic drainage of all lands composed largely of clay, or clay loam, devoted to cereals or roots, even though considerably elevated or inclined. Much can be accomplished, however, by the systematic growing of the various grasses, not as food for stock alone, but as a means of enriching the land and improving its mechanical condition; so that corn, wheat, potatoes, &c., shall be regularly and certainly remunerative in all seasons. The State is eminently suited to the growing of grass, but it is not best that it should become exclusively a grazing State, a diversity of productions being requisite to prosperity. Every farmer should have sufficient pasturage to furnish good feed for all his stock; some green crops should be grown to feed milch cows and other stock when pastures become short in August, and enough hay should be cut to feed in winter the stock kept on the place; but no farmer can afford to raise hay for sale. The proceeds of the hay are taken from the land, the latter being impoverished fully in proportion to the value abstracted, and no one can profitably pursue a course of farming which impoverishes his land.

Farmers can raise remunerative crops of nearly all kinds every year if the soil is in the right condition—not only large crops in favorable seasons, but in the wettest and the driest and the shortest seasons. This condition is found ready made in new land composed largely of vegetable mold, not too wet or springy, and with sufficient sand in the soil to permit natural drainage. Such soil will grow corn and potatoes well in a wet or a dry season. At the time of writing, Mr. Soule knew of no corn on new land, well supplied with leaf mold, which was well prepared and well planted, in good season, and well worked, but would prove a remunerative crop; whereas the corn on old or poor land, or that which was poorly worked on comparatively good land, would be hardly worth harvesting. New land cannot always be had, however; hence the requisite condition must be secured otherwise.

All plants need a certain degree of moisture in the soil to secure healthy and vigorous growth. When the soil is filled with water to that degree that it is called mud, most plants grow but little, and some die. The excess of water prevents the air and heat from penetrating the soil, and the necessary chemical changes to feed the plant cannot take place. The air also furnishes nitrogen, ammonia, &c., for the plants. If the soil is too dry plants cannot grow vigorously, as water is essential to the solution and preparation of the mineral elements of the soil necessary to plant life, and also furnishes carbon, hydrogen, and oxygen for the

plants. Plants can grow only when all the ingredients of their composition are supplied at the same time, and in a chemically prepared condition, so as to be absorbed by the roots. We must so manage that the soil shall be furnished with a certain degree of moisture as well as air. We need to have the soil in that mechanical condition (fineness, or coarseness, compactness or looseness,) that the water which falls upon it may penetrate it, carrying its richness to the roots of the plants. The greater your store-house of water the better; and the soil should not only permit the rain to penetrate in abundance, but it should be in condition to lift the water up toward the surface as the latter becomes dry, both of which are practicable when the soil is loose and pulverized. The ill effects of heavy rains may be avoided to a great degree, by working the soil to a greater depth, and still further by creating a vegetable mold, by growing grasses, so that the particles of clay or loam may be held apart, and prevented from running together.

Take a field of clay loam that has been poorly cultivated until the vegetable mold has been mostly consumed by the growing crops, it will produce little corn, less potatoes, and but a small and uncertain crop of wheat. It surely needs enriching, but its mechanical condition needs changing as certainly. Stable manure would enrich it and somewhat improve its mechanical condition; straw plowed under would do the same, but it is difficult to plow under. These are not always convenient, however, and involve considerable labor; but the field could be seeded to some of the grasses, in connection with wheat, rye, or even oats. A light dressing of manure should be added to invigorate the grass and other crop. Ashes, leached or unleached, scattered on the surface as the crop is coming up, or early in the spring, would be beneficial. Plaster generally produces a marked result upon any of the grasses, especially clover. Make a good effort to get the grass to grow. Clover enriches the soil more than other grasses; and, if plowed under when in blossom, the soil is greatly enriched by the tops, as the grass is rich in fertilizing qualties; and the roots make vegetable mold, and aid in improving the mechanical condition of the soil. Clover will not do well on flat and springy land, timothy being preferable. Where the land is not too wet for clover, and the latter is not to be cut for seed, sow both timothy and clover, as the latter is liable to freeze out. When mixed they succeed finely. With this turned under and the field planted with corn the following spring, the corn comes up vigorous and strong, with healthy color, grows rapidly, and produces strong stalks, and large, well filled ears; the soil does not become compact and hard after a soaking rain. The corn being so much more vigorous and the soil looser, the corn is quite safe against any ordinary drought by having taken deep root.

The grass has converted the mineral substances of the earth and the gases of the air and water into organic matter, new vegetable mold, and furnishes a large supply of food in a condition that is easily incorporated into the growing plants. This mold furnishes not only fertility and drainage, and keeps the particles of the soil from running together when excessively wet, but also furnishes a sponge, as it were, which raises the water up toward the surface by capillary attraction in case of drought; while it is peculiarly fitted to prevent too rapid evaporation of the water, and to secure and retain the ammonia from the dew and rain. The effect of this vegetable mold is greatly beneficial to the wheat crop, giving a vigorous growth, and preventing winter-killing by heaving out; and the potato crop receives even more benefit than corn from the decomposing sod and grass.

IOWA.

REPORT OF THE SECRETARY.

Cattle.—The report of Dr. J. M. Shaffer, secretary of the State Agricultural Society, states that the farmers of Iowa have made slow progress in the improvement of cattle, and that the possession of the Durham, the Devon, or the Ayrshire breed, is confined to very few persons, there being great lack of appreciation of the importance of improved stock. Total number of cattle of all ages, 956,169; butter made, 19,192,727 pounds; cheese, 1,403,864 pounds; cattle sent east, (over the several railroads from which returns were received,) 64,846 head, being one-fifth the receipt at Chicago.

Hogs.—Chester White, Magee, Suffolk, Poland, and Berkshire are the popular breeds. Number of hogs in the State, 1,620,089; shipped east, 334,265, (one-fifth Chicago receipts,) not including 11,119,880 pounds dressed hogs, 7,365,606 pounds pork, and 2,679,398 pounds lard, shipped east and west, the lard making up one-fourth of the Chicago receipts.

Sheep.—Remarkable fluctuation is noted in sheep raising. Importations of sheep in 1863, 70,118; 1864, 159,519; 1865, 33,116; 1866, 5,972; 1867, 4,368. Exports: 1863, 6,289; 1864, 16,585; 1865, 20,755; 1866, 52,589; 1867, 30,461. Number of sheep in the State, about 2,000,000; wool exported, 2,086,147 pounds; whole wool clip, nearly 8,000,000 pounds—an increase of more than 2,500,000 pounds over 1866. Loss of sheep by dogs in 1864, $126,148; in 1866, $88,267; amount for 1867 not ascertained. In this connection it is stated that, while a few years ago Iowa was entirely dependent upon other States and countries for woolen goods, this state of things is now changed to a considerable degree, the manufactures of the State reaching $25,000,000 in 1867 against $2,751,805 in 1862, and $15,957,599 in 1866, a large proportion of which were woolen goods.

Wheat.—The crop is stated to have been unparalleled in quantity and unsurpassed in quality. The exports for the year over six railroads named reached 6,539,628 bushels, being one-fourth of the receipts at Chicago. The secretary deprecates attention to wheat to the exclusion of a diversity of crops; and says that, with a good crop under thorough cultivation, Iowa alone could raise sufficient wheat for the whole country, adding: "I can name ten prairie counties in Iowa with 5,000,000 acres, which, at ten bushels per acre, would produce wheat enough for home consumption, and supply a larger amount of wheat and flour than passed through Chicago in 1867, which facts justify our cautious lookout for cheap wheat. Diversify agriculture and regard grasses and animals, which promise good profits, and leave wheat-raising to the young pioneer on virgin soil, and to farmers in close proximity to railroads."

Corn.—Crop about 70,000,000 bushels; shipments by rail, 1,701,866 bushels, a large proportion of the crop being consumed at home.

Oats shipped by rail, 617,689 bushels; rye and barley, 621,565 bushels; other grains and seeds, about 6,250,000 pounds.

Sorghum.—In 1858 the acreage of sorghum was 5,606, product 410,776 gallons, or 74 gallons per acre; 1862, 37,607 acres, 3,442,396 gallons, or 96 gallons per acre; 1864, 21,452 acres, 1,543,604 gallons, or 67 gallons per acre; 1866, 25,796 acres, 2,090,557 gallons, or 81 gallons per acre; 1867, product about 3,000,000 gallons. Product of sugar in 1862 was 21,469 pounds, one to 140 gallons of sirup; in 1864, 8,386 pounds, one to 172 gallons; 1866, 14,697 pounds, one to 143 gallons. The productions of sugar are rather the results of accidents than of any well-digested

system for its extraction from the sirup; but these figures show that sugar really exists in the sirup. One gallon of sirup should furnish five pounds of marketable sugar, and leave half a gallon of excellent sirup, a result which would have realized 10,452,785 pounds from the crop of 1866, and probably more from that of 1867. Counting the sugar at 15 cents per pound, the crop of Iowa alone would amount to $2,250,000. The people are not generally aware of the extent of this crop, and do not appreciate its value; but, in the experience of the past, there are abundant reasons for more enlightened effort to establish the crop as a staple western product, as it is no more liable to failure than Indian corn.

County societies.—Forty-five county societies made reports for the year Number of members, 11,375; receipts, $25,477; paid out in premiums, $18,180; leaving an average of $162 50 to each society for current expenses.

State fair.—At the fourteenth annual State fair there were 1,796 entries, 462 more than ever before; receipts $9,528; paid in premiums, $4,350.

Railroads.—In 1863 there were 574 miles of railroad in the State, 793 miles in 1865, and 1,152 in 1867.

Timber.—The secretary states that among the wants of Iowa are artificial groves of timber, and careful husbandry of the natural forests. In 1863 there were in the State 8,360 acres of timber, and 4,786,886 acres of inclosed lands, being one of timber to each 260 inclosed land; in 1866, 45,774 of timber, 8,263,174 inclosed land, one to 170—an encouraging increase of timber. To illustrate the importance of more general cultivation of timber, it is stated that the railroads of Iowa consume about 35,000 cords of wood, and those of the whole country, 6,700,000 cords; and that for repairs of existing roads in the State, including bridges, ties, &c., the annual expense is not less than $670,000. From the several sources from which figures were attainable, 119,166,307 feet of lumber and 84,980,958 shingles and laths were imported for use in the State during the year. The secretary affirms that the profit from a five-acre grove will be greater than from any other product, and urges legislative encouragement for more general cultivation of forest trees.

REPORTS OF STANDING COMMITTEES ON FARM STOCK.

Cattle.—The standing committee on cattle report a series of sub-reports from counties, all indicating limited though increasing attention to improvement of stock. Durhams everywhere rank highest for beef. The Adams County correspondent, after thirty years' experience in raising cattle and in dairying, considers the Durhams best for beef, Devons for the yoke, and Ayrshires for milk, and adds: "In raising cows, feed the calf until a cow, on the food that will make the cow give most milk, and you will have a milker. In raising a steer never let him get poor; change feed frequently; and, in feeding high, give plenty of salt, as nine-tenths of all the diseases of animals are brought on by want of salt. It is just as easy to have the steer at four years old weigh 2,000 pounds as 1,300. There will be from 300 to 500 pounds difference between a common scrub and a tall, long, wide-spread Durham." The reporters for Frémont and Jasper prefer the Durhams for beef, and the half-breeds for the yoke and milk. Another writer says that Durhams make an earlier growth, and are more perfect in form; and the steers two and a half years old will bring more than scrub stock at three and a half years old. Shorthorn steers may be got ready for the shambles at two years old, if required,

weighing from 1,100 to 1,300 pounds gross, while common stock will not weigh more than 500 to 800 at the same age, and not be fit for market at that. A Lee County correspondent says the Durhams are best for the shambles, and for the yoke a cross between the Devon and Durham, the former adding activity and speed to the latter, making pretty working cattle, easily matched. For milk, if feed is plenty, the Durham; if not, the Devon or Ayrshire; or, if short hill-side pasture is to be the feed, an Alderney.

Horses.—The report on horses exhibits a want of interest in thorough-bred stock in Iowa, and a general inclination among farmers to use the nearest and cheapest stallions. James Grant, of Davenport, writes that not one in ten of their farmers would breed with a thorough-bred horse at ten dollars if he could get a cheaper horse, though aware that the colt of the former will command more money. Blackbird stock and the Bashaw-Messenger are held in the highest estimation. With others the Morgan stock ranks first, and for heavy horses the Connestoga, Bell-founder, and Printer. The increase in population requires more than the natural increase of horses; hence there is inducement for horse-raisers.

Mules and jacks.—Increased attention is being given to mule-raising, and blooded jacks are becoming more numerous. The value of mules, for work, profit, &c., is estimated at from twenty-five to thirty-three per cent. over that of horses, and a mule three years old is considered as good as a horse at four or five. Those having mares of good blood, speed, and symmetry should breed horses, but from common mares it is more profitable to raise mules. One reporter says the proper method of raising colts is to feed them all the hay and oats they will eat; teach them to eat by feeding with the mare, and they will not mind weaning: by this course they will sell out of the pasture at common prices for two-year olds. It is stated that mules do not get their full growth till in their teens, and that they should not be put to their greatest effort before they are ten years old.

Swine.—The report on swine is made up chiefly of statements of local correspondents, from which it appears that the Magee, Chester White, Suffolk, Poland, Berkshire, and China, with their crosses, are the most popular and profitable breeds, each finding preference in certain localities. One writer thinks the Magee the best breed without a cross, but that it is improved by crossing with the Chester White, the pork selling for 25 cents per 100 pounds more than common hogs; also, that four bushels of meal cooked is better than five bushels of corn in the ear; that no kind of stock pays better than hogs, if properly managed; but that they should never be wintered, but marketed at from eight to ten months old. Another writer says that it pays better to raise hogs than sheep, but not half so well as to raise cattle or horses; that it costs more to produce $100 worth of hogs than $150 worth of cattle: that 15 bushels of corn will produce 100 pounds of pork, worth $4, and 90 bushels of corn will produce 1,100 pounds of beef, worth $66, making corn fed to hogs bring 26 cents, and that fed to cattle 73 cents per bushel. The statement from Monona County names cattle as the most profitable stock to raise, horses next, sheep third best, and hogs fourth. In Jefferson County the relative profits are estimated as follows: A hog of best breed, 320 pounds, costs $11 50 and sells for $16, profit $4 50, or thirty-nine per cent. on cost; common breeds yield no profit; to raise and fatten a grade Durham steer, four years old, 1,600 pounds, costs $59, worth in market $96, profit $37, or sixty-two per cent. on cost; a scrub steer costs $48 80, worth $60, profit $11 20, or twenty-

three per cent. on cost; farm horse, four years old, costs $85, worth $125, profit $40, or forty-seven per cent. on cost; a good roadster costs $100, worth $200, profit $100, or 100 per cent. on cost. The same correspondent deprecates the practice of breeding hogs in-and-in as a fruitful source of disease; and thinks that proper breeding, feeding, shelter, and general good treatment of swine would do more as a preventive of hog cholera than all the drugs in the shops. To cure hogs really taken with the cholera he knows no remedy, but effort should be turned to preventing its spread. The sick hogs should be immediately separated from well ones, and given some simple medicine, say saltpeter one part, sulphur two parts—a large spoonful three times a week. Hogs that die should always be buried where no others can get at them, lest the disease be extended by the carcasses being eaten by well hogs.

Sheep.—The committee on sheep and wool-growing report that farmers have become greatly discouraged in this branch of husbandry; that many inexperienced in the business had failed; but that few who really understand it are willing to give it up; and it is believed that, if those who are experienced will persevere, they will ultimately receive fair remuneration for their labors. One correspondent estimates the cost of wintering at 80 cents to $1 per head, and the value of sheep for mutton at $3 50 to $4 per head at home.

REPORTS OF STANDING COMMITTEES ON FARM PRODUCTS.

Wheat.—The report on grain shows that of spring wheat, preference is given to the China Tea, Fife, Canada Club or Goose, Rio Grande, and Italian; and of fall varieties, to the Mediterranean, White Winter, Early May, Blue Stem, White Genesee, Smooth White-chaff, Smooth Golden-chaff, and Tappahannock, the latter having been recently introduced from the Department of Agriculture, and promising well. In answer to a question as to whether wheat is as remunerative as a crop of corn or the grasses, the sub-reports are pretty evenly balanced, the number preponderating against the wheat crop, however, taking a series of years. One writer, with fourteen years' experience in testing the comparative profits, thinks either corn or meadow grass more remunerative than wheat. Drilling is gaining favor generally, though in some cases the system has been discarded.

Corn.—Yellow corn and White Dent corn are chiefly grown throughout the State. The cost of raising is about $5 50 per acre, taking the average of about twenty estimates from different sections. All report it a remunerative crop. One farmer says he has raised ten successive crops of corn without deterioration of yield; and, as a rule, no fertilizers are used, though the almost universal testimony is that cultivation largely increases the crop, frequently doubling the yield.

Rye.—But little raised; when not distilled, it is used for stock. With but one exception it is reported a profitable crop where tried.

Oats.—The common white variety is principally grown, with Black Horse Mane, Side, Poland, and common black, in less quantity. The crop is largely consumed at home, for which it is considered as profitable as other small grains. Some correspondents say it does not pay as a market crop, while others quote the price at 25 to 35 cents, and report it "very remunerative."

Buckwheat.—Not extensively grown, and chiefly for home consumption. In Jefferson it is reported "tender and uncertain." In most counties it does well, and nearly all reports rate it a paying crop; one says, "profitable, but troublesome." In a few counties it is cultivated

for the bees. The Floyd reporter says: "We sow the gray buckwheat, and average 40 bushels to the acre."

Barley.—In many counties little or none grown. In the vicinity of breweries it is considered a profitable, as well as a pretty sure crop; and several report very favorably of it as a crop for stock feeding, pronouncing it better than corn and oats for horses and hogs. One reporter says it pays to raise it at 70 cents per bushel. The spring varieties are generally sown.

A correspondent justly complains of the confusion of names for cereals and root crops, the same wheat having a dozen different names, and potatoes as many more. A neighbor went eighty miles for a new variety of the Golden-straw wheat, which was sown and found to be Scotch Fife. Such instances are frequent.

Sorghum.—The destructive frosts of 1866, and the high price of small grains, the backward spring, and poor seed in many cases, together with the want of market for surplus product, and the expense of good apparatus for manufacturing the sirup, are named as the causes of the decline in the cultivation of this crop. The White and the Red Imphee, and the Chinese cane are the varieties preferred. In Louisa County the Red Imphee is considered the best for sirup, and the White for sugar. The reporter says: "The Red will not make sugar; the White, all that I have made, went to thick mush sugar immediately, some of it before it was entirely cold." Another says the Chinese is the best variety; upland produces the finest sirup; bottom land the longest growth of stock. In Humboldt the China and the Otaheitan are preferred, the former for large yield, the latter for granulation: "Poor cultivation deteriorates the quality of the product; fertilizers hasten maturity, increase the yield, and improve the quality of the sirup. There is no lasting impediment, unless it be laziness, to the profitable raising of sorghum. Light sandy soil produces the best sirup, while a rich soil produces a greater quantity of a darker quality." James Pemble, of Louisa County, writes that the cane should go to mill fresh from the stalk, and that he commences making as soon as the seed is in the milk. He uses Skinner's mill, with pans of his own contrivance, his whole apparatus costing $125, and makes 125 gallons per day, and from 2,500 to 3,000 gallons the season, selling last season at 90 cents per gallon by the barrel, with ready sales. It is not thought profitable for each farmer to have a mill; one being sufficient for a neighborhood, and is thus made profitable.

REPORTS OF STANDING COMMITTEES ON FRUITS.

Grapes.—A large majority of the sub-reports pronounce the Concord first on the list, all things considered. The counties report in substance as follows:

Benton County: Concord, Hartford Prolific, Clinton, Delaware, and Rogers's Hybrid, No. 4, esteemed most highly; Concord and Clinton, mixed before crushing, best for wine. Des Moines County: Concord for profit; Delaware, Iona, and Creveling for quality; Concord and Catawba for wine; $1,800 realized from six acres last year. Dubuque County: Concord and Delaware. Frémont County: Concord the favorite; Isabella and Catawba do well. Jefferson County: Delaware and Concord for table; Iona, Isabella, Diana, and Hartford Prolific successful; Clinton, splendid wine grape; one vintner made 350 gallons to the acre, worth, when sold by the gallon, $700—put up in bottles, $1,100, after deducting extra expense and labor. Fairfield County: the reporter raised

5,000 pounds per acre, sold at 15 cents per pound, $750 per acre. Jones County: Catawba best for wine; Concord, Diana, and Delaware for table; Diana for packing for winter; Hartford Prolific and Isabella also favorites. Lee County: Catawba best for wine and table. Harrison County: Concord, Diana, Isabella, and Iona for table. Henry County: Concord best; Hartford Prolific and Creveling stand next for hardiness; Concord and Clinton for wine; crop of the county 14,500 pounds; 650 gallons of wine, chiefly Concord. Humboldt County: Concord and Clinton. Mahaska County: Concord, Delaware, Clinton, Elsingburg, and Catawba for wine; Concord and Delaware for table; 16,000 vines in the county, 5,000 bearing fruit; yield, 32,000 pounds; cost of vineyards: preparing ground $100 per acre, vines $150, trellising vines $150, tending four years till first crop $300, $700 before returns; one man can tend three acres of grapes as easily as twenty acres of corn; the three acres will yield $1,200, besides about $1,000 worth of cuttings; 800 vines to the acre, which at four years old yield 8,000 pounds, at five cents per pound, making $400 per acre. Marion County: Delaware, Concord, Diana, Rogers's Hybrids Nos. 2, 3, 4, 13, 19, and 42, Perkins, and Baldwin. Story County: Concord and Delaware. Taylor County: Concord. Union County: Delaware and Diana for wine; Iona for table. Washington County: Concord; 60,000 vines in county, nearly all Concord; eight tons per acre the average crop of Concords, which will make 1,200 gallons of wine; the Concord needs no protection; the Clinton is a good wine grape; 3,000 gallons of wine made in the county in 1867, principally Concord; the Concord has not suffered from mildew or rot; all other varieties subject to disease. Considerable injury was reported in various sections from sun-scald, mildew, rot, lice, beetles, &c. Clinton and Isabella much injured by rot.

Raspberries.—Purple Cane, Black Cap, Philadelphia, Kirtland, and Catawissa are the only varieties reported entirely successful. Several report having tried the Red and the Yellow Antwerp, Fastolf, Knevitt's Giant, Large Fruited Monthly, Brinkle's Orange, and several other varieties, but have found them all tender.

Strawberries.—Wilson's Albany, Russell's Prolific, Triomphe de Gand, are mentioned with favor by the few reporting. Our correspondent says Russell's Prolific is the favorite, with a few of Wilson's Albany set near for fertilizers. Another writes that the best early varieties are Jenny Lind, Downer's Prolific, McAvoy's Superior, and Wilson's Albany; but for shipping, the Agriculturist.

Cherries.—The Early May or Richmond is held in highest esteem, maturing early and adapted to all localities, and is of excellent flavor, and a profitable tree. Eight bushels, from three ten-year-old trees, sold for $32. For a late cherry, the English Morello is a hardy and good bearer.

Currants.—The Common Red, Red Dutch, White Dutch, White Grape, Gondouin White, Cherry, Versailles, and Fertile de Palluau are named as successfully grown. One reporter says the Common Red and the Gondouin White are the sweetest, and the Red Dutch and White Grape the largest, he has tried. Another values the Cherry currant for size and yield, but thinks the old Red Dutch, with good ground and thorough culture, hard to beat.

Gooseberries.—Houghton's Seedling and Downing's Seedling appear to stand at the head of the list, followed in order by Hickson's Favorite, American Seedling, and Chester White. The worms have done much injury to the bushes, and mildew has seriously affected the English varieties.

COUNTY REPORTS.

Apples and pears.—In the county reports to the secretary the following varieties are named as successfully tested apples: Red Astrachan, Wine Sap, Sweet June, Oldenburg, Sexton, St. Lawrence, Fameuse, Tolman's Sweeting, Golden Russet, Summer Pearmain, Rambo, Maiden's Blush, Rawles's Janet, White Winter Pearmain, Romanite, Pennock, Winter Sweet, Red June, Limber Twig, Jonathan, New York Pippin, Roman Stem, Red Transcendent Crab, Yellow Transcendent Crab, Harris's Fall Russet, Seek-no-further, Gros Pommier, Dominie, Spitzenburg, Small Romanite, Vandevere Pippin, Willow Twig, Duchess of Oldenburg, St. Lawrence, Yellow Harvest, Prince's Harvest, Hess, Yellow Ingestrie, Yellow Bellflower, Keswick Codlin, Cole's Quince, Early Harvest, Early June, Summer Queen, Snow Apple, Perry Russet, Saxon, Red June, Benoni, Roman Stem, White Bellflower. Pears: Gray Doyenné, White Doyenné, Bartlett, Flemish Beauty.

Fruits in Jefferson.—There are in this county 142,422 fruit trees, 59,720 of which are in bearing; and Madison has over 100,000 fruit trees planted. Want of success in apple culture is attributed to injudicious selections, poor cultivation, and the ravages of the borer and caterpillar. A reporter says the ravages of the latter may be prevented by tying a bundle of oat-straw around the tree, with the tops down, so that when the worms begin to climb, they will cluster in the oats, when the sheaf can be removed and burned.

SMALL FRUIT CULTURE.

Currants.—In a paper on Small Fruits, M. Cousins, jr., recommends the old Red Dutch as the most reliable. It has superiors in size and delicacy of taste, but none in its early responsive faithfulness to the husbandman's care. The Versailles, White Grape, White Dutch, Black Naples, and Victoria are also highly approved for their respective qualities. Currants can be made a profitable crop. Set them three by four feet, 4,000 to an acre. One quart to a bush will give 4,000 quarts, which at five cents per quart (they brought twenty in Chicago last summer) make $200 per acre. The cuttings and roots will pay expenses. No danger of glutting the market. The cheapest method of propagation is by cuttings. Layers may be made by bending down and covering the new growths or shoots, by which one year may be saved, and strong plants secured.

Cherries.—Of this fruit, he says, only the red or acid varieties succeed well in the west. He never saw a bearing Bigarreau, Heart, or Black cherry tree in the prairies, the tart Kentish varieties, the Early May, and the Morellos being the only hope. The Early May never totally fails.

Strawberries.—On a patch of several acres near Burlington, containing forty varieties, Downer's Prolific, Wilson's Albany, McAvoy's Superior, and Jenny Lind are pronounced the best four varieties. Russell's Prolific also fruits well. The Wilson enjoys the widest reputation, and it seldom fails.

SUEL FOSTER ON FRUIT CULTURE.

Upon this subject Suel Foster says that an acre of good, rich land, planted in the spring with Wilson's Albany, in rows three feet apart and one foot in the row, carefully hoed and cultivated, and covered lightly

with straw in December, after the ground freezes, the straw raked into the middle of the rows in spring for mulching, will produce twenty bushels the second and the third year, and sometimes one hundred to the acre, worth from $3 to $8 per bushel.

Grapes.—Mr. Foster expresses the opinion that grape-growing will be overdone in Iowa; not by the farmers, but by vineyard planters; the supply of wine will be greater than the demand. The fruit will be profitable to raise near large cities, but he thinks 200 to 500 miles transportation will not pay when prices get down to five cents per pound. Every farmer, however, should have at least twenty-five vines for home supply. Plant a few Hartford Prolific or Creveling for early fruit, but the principal variety should be Concord.

Plums are pronounced not very profitable, the trees being apt to blight and die. Pears do best on clay soil.

Cherries.—The Early Richmond (or Early May) is the only variety of any profit in the hard winter climate of Iowa. Fruit second rate, but tree very hardy and productive; a profitable fruit to plant by the acre for market. Set trees about fourteen feet apart, and let them bear low for convenience in picking.

Apples.—The best of all our fruit, and most profitable for the labor bestowed. He thinks Iowa one of the best fruit regions in the Union, and names the Yellow Bellflower, Rawles's Janet, Rome Beauty, Wine Sap, Willow Twig, Ben Davis, Sweet Romanite, Virginia Greening, as varieties he would recommend, though there are others as good. To prevent rabbits gnawing, wash the trees with lime and tobacco. For the canker-worm use sorghum molasses, thickened with flour, and rub on the tree from the bottom one foot high, or burn the worms by spreading a very light wad of straw under the tree; beat and shake the worms off; scrub the bark off trees, it is a harbor for insects. Wash with soap and water.

THE PROPAGATION OF EVERGREENS.

In another paper Mr. Foster urges all nurserymen of the prairie country to commence immediately and earnestly the propagation of evergreens, and thus to cheapen their price. Varieties recommended for timber: Norway pine, Scotch pine, White pine; for wind-breaking screens and ornamental hedges: Norway spruce, hemlock, balsam, and fir. He does not value the red cedar or the white as highly as before trying them. It is not advisable to plant apples among evergreens, as the former are likely to run too high; but there should be a row on the north and west to break the winds of both winter and summer; and, instead of planting one row six or eight feet apart, plant two rows twice the distance.

SHOEING PRAIRIE FARM HORSES.

W. W. Beebee, in a paper upon this subject, says that, for common farm work, and all usual adjacent travel, horses need no shoes. God has made an amazingly light but wonderfully strong hoof for the horse, fully adequate to all ordinary, and, by constant care and use, to many extraordinary necessities. Mr. Beebee drives and works a span of one thousand pound horses that have not had shoes on their fore-feet for five years, and never on their hind feet. He avoids heavy hauling while ice prevails, but drives them then, even up and down hill, as fast as the best of shod horses. They were made lame by shoeing, but never since, and their

hoofs are now well nigh as hard as iron. Therefore, keep shoes off of colts and young horses as long as possible; and, if their feet become tender upon frozen ground, let nature have a few days to increase her power of resistance. Mr. Beebee also deprecates the practice of binding down upon the forehead, under heavy or close bridle reins, that foretop which was evidently designed to fly loose in the breeze.

RAISING SWINE.

Causes of disease.—L. W. Stuart, in an article upon hogs, expresses the opinion that the great causes of disease among this class of animals are the want of improvement in breeding, breeding in-and-in, and breeding too young, impairing the physical qualities of the animals and rendering them unable to endure the hardships to which they are exposed, from lack of care and protection.

Feeding.—In reference to feeding he says: Give pigs plenty to eat while they are young, as it will pay twenty-five per cent. more to feed well then than at a more advanced age. Strict regularity in feeding is recommended; hogs fattening should have just what they will eat and no more; be fed three times a day, and be kept where they can get clean fresh water. To make the greatest amount of pork in a given time, obtain the best breeds—such as will not break down on a plank floor—keep their pens clean, and feed regularly three times a day until ten months old, when they should weigh 400 pounds.

On the 2d of June Mr. B. put up three pigs eight weeks old, and fed them until September 18. At the end of the sixth week one of the three, a sow of a good native breed, had to be removed from the floor, showing signs of breaking down. At the commencement of the experiment this pig weighed 45 pounds, increased to 80 pounds July 10. The other two, Chester white boar and sow, weighed 55 pounds each at penning, 115 and 111 pounds respectively at the end of the six weeks; and at the end of the sixteen weeks 258 pounds and 250 pounds respectively. The highest weekly increase was 21 pounds, the average for the boar $13\frac{1}{4}$ pounds, and for the sow about $12\frac{1}{5}$ pounds.

In feeding 100 hogs Mr. B. has made a saving of two-fifths of the grain by grinding it up into meal and feeding it dry; and finds still better results by souring the meal before feeding; and by steaming food the best results are attained, making a saving of over one-half. The opinion is also expressed that the man who feeds blooded stock gets just about double for his grain that the man does who feeds native stock.

MISSOURI.

REPORT OF THE SECRETARY.

L. D. Morse, corresponding secretary of the Board of Agriculture, reports that the year 1867 was one of general prosperity to the farmer; that the immigration to the State, especially during the fall, was so large as to make a remunerative home market for food crops in many localities; and that agriculture now presents one of the most profitable and certain fields open to capital and labor. In evidence of the general prosperity it is stated that the total value of taxable property in the State in 1860 was \$295,552,806, while in 1867 it reached \$454,863,895, being an increase of thirty-five per cent., while the number of polls taxed in 1867 falls nearly 12,000 short of the number in 1860. This increased valuation is mainly attributable to an improved condition of agriculture.

Manufactures.—The rapid growth of the manufacturing interest is also remarked upon, and the fullest encouragement to its further development urged as of vital importance to the State, the true policy being to bring the producer and the consumer as nearly together as possible; and to this end the suggestion is made, that the State exempt capital invested in manufacturing establishments from taxation for a period of ten years.

Wool-growing.—The secretary claims unequaled advantages for wool-growing in Missouri, and assumes that wool can be grown at less than one-half the cost for which it is produced in New England. Not less than 50,000 sheep were driven into the State during the latter half of the year, from Iowa, Illinois, Indiana, Ohio, Wisconsin, and even Vermont. As in other sheep-growing districts, a dog law is demanded for the protection of flocks.

Cisterns.—The secretary quotes the protracted drought of the summer as a practical argument in favor of cisterns for rain water, to insure a supply for almost any emergency. For household use one cistern at least should be deep enough to keep the water cool in summer, not less than sixteen feet deep, but twenty feet is better. Such a cistern should be walled up with brick or stone laid in cement mortar, to exclude the surface drainage or other filth which passes through the soil into wells. The cistern for family use should be provided with a filter, for which purpose a good method is to dig a small cistern adjoining the large one, about five feet wide by five feet deep, connected about a foot above the bottom with the large one by a pipe, and filled two-thirds full of sand and gravel. Into this the water from the roof is discharged, and filters through into the deep cistern. Small cisterns may be made in clay soils by cementing on the earth. Ponds may be constructed in most localities, which will contain an abundance of water for stock.

Forest trees.—To guard posterity against the excessive droughts which must follow the denuding of the country of timber, farmers are urged to save, as far as possible, all young trees, and to begin in earnest the planting of fruit trees, making it a point to plant some every spring. In a few years they will grow to a size to be of important service. Shelter belts along the sides of farms are useful in a prairie country, and are soon appreciated by farm stock as shelter from chilling winds and rains, ameliorating the severity of winters and the drought of summers. The following is given as the average growth in twelve years of some of the leading desirable varieties of forest trees: White maple, one foot in diameter and 30 feet high; ash-leaf maple, one foot diameter, 20 feet high; white willow, 1½ foot diameter, 40 feet high; yellow willow 1½ foot diameter, 35 feet high; Lombardy poplar, 10 inches in diameter, 40 feet high; blue ash and white ash, 10 inches diameter, 25 feet high; black walnut, white walnut, elm, and chestnut about the same; hickory, eight inches in diameter, 25 feet high. Evergreens make an average growth of 20 inches in height annually, and many make more.

GRAPE CULTURE IN MISSOURI.

An article on grape culture in Missouri, by Professor Swallow, shows that the State possesses many species of native grapes, and the vines are so abundant and large as to form a conspicuous part of every copse and thicket throughout the State; and that both scientific examinations and experience prove that the vine can be cultivated with entire success in favorable localities in all parts of the State.

The vineyards of Booneville yielded last year about 6,000 gallons of

wine, worth $12,000; five acres gave a clear profit of $2,000, and a vineyard of three acres yielded 1,550 gallons of wine. The vintage of Hermann was about 100,000 gallons from less than 200 acres, which, at $1 per gallon, gives a profit of $400 per acre. One small vineyard at Hamburg produced over 1,000 gallons per acre. The cost of vineyards for preparing the soil, setting and training the vines till they come into bearing, varies from $200 to $300 per acre; subsequent cost of cultivation, $50 to $60 per acre; ten per cent. on first cost, $20 to $30 per acre; total expense for each year, $70 to $90 per acre; so that an income of $100 per acre will pay interest on first cost and expense of cultivation. The writer supposes the vineyards of the State have yielded an average of at least 250 gallons per acre since 1849, which, at $1 60 per gallon, would give an annual income of $400, and a net profit of $300 per acre. One vintner of Hermann is said to have made over 400 gallons per acre for the last ten years, and an annual profit of more than $500 per acre.

Millions of acres of land slopes and ridges in central and in southern Missouri, now considered worthless, are in fact the most valuable lands in the State for grape culture; and it is stated that 5,000,000 acres might be selected in the most desirable locations, and devoted to vineyards without encroaching upon the lands most desirable for other branches of agriculture, and that these 5,000,000 acres in the highlands of southern Missouri present rare inducements to the vine-dresser.

WINE DISTRICTS OF MISSOURI.

In an article on the wine districts of Missouri, J. Vancleve Phillips ranks the lands in St. Louis County as third and fourth rate wine lands, since they lack the proper oxides of iron to grow grapes to any great extent. Washington, in Franklin County, and Hermann, in Gasconade County, are similarly designated; it being remarked that when the vines are first planted, say for six or eight years, the fruit will be comparatively perfect, as the distribution of elements through the clay has been sufficient for the temporary support of the vine; but, as soon as these are exhausted, the leaves will be attacked by blight, and the berry by mildew and rot. On the dividing ridge between the Maramec and Bourleuse, from St. Clair to Knob View, may be found choice lands for planting vines. The district around Potosi, Missouri, is represented as peculiarly favorable for vine-growing. The writer states that there are 2,000,000 acres of natural vine lands on the northern slope of the great watershed, dividing the waters of the rivers that flow north to the Missouri, and the rivers that flow south to the Arkansas. This dividing ridge being known on the maps as the Ozark Mountains, extending west from the Iron Mountains. The belt of the true vine lands commences at about 400 feet altitude, and extends up to 800 feet, as demonstrated by the growth of wild grapes; and it will be noticed that the lands planted in St. Louis County, and at Hermann, and other points in the counties of Franklin, Washington, and Jefferson, except at Massey's, St. Clair, are below 400 feet. From all information gained in the author's survey of this region the lands that contain all the elements necessary to grow vines permanently, and are of the proper altitude, are in the iron fields of Franklin, Crawford, and Dent. Next, the lands in the lead fields in Washington, St. François, St. Genevieve, and Madison; the sloping uplands along the sides of limestone ridges, where deep red clays are found, being the best; and the next in St. Louis, Jefferson, Franklin, Perry, and Cape Girardeau, where the lands have the greatest altitude, and the clay over the rock is red, and contains a

good supply of the oxide of iron. The first-named lands, when properly cultivated, will produce 500 gallons of Catawba wine per acre the fourth year from planting, increasing annually.

PEACH CULTURE.

W. C. Flagg, in an essay on peaches, says that from his experience and observation the variety with the fewest objections is the Old Mixon Freestone; and that for a list of four market varieties which will nearly cover the season, and against which few objections can be urged, he names Troth's Early, large Early York, Old Mixon Freestone, and Smock Freestone. He also states that in that latitude peach orchards should be planted on the highest eminences or ridges, both on account of the frosts in cold weather, and good ventilation in warm; that the ground should be plowed deep for peaches and all other fruits; and that the best distance is twenty feet apart, unless special pruning is resorted to. In reference to pruning, he says that something like pyramidal pruning is best for the peach tree; that in his warm climate it is not necessary to leave a hollow head to admit the sun, and that he finds trees with leaders standing up to their work better, lasting longer without splitting down, and freer from disease both of tree and fruit. For marketing peaches, boxes are objected to, for the reason that the corners bruise the peaches, and a return to baskets is recommended. A basket that is highly approved is made much like a firkin, with three hoops. It can be shipped by railway without damage, holds one-third of a bushel, and is intended to be returned two or three times. The sides are tulip-tree wood, the covers and bottoms pine. It is made upon a frame, formed by setting three disks of iron upon a spindle. The inner and the outer hoops are set in the top, and a lath set in place, and this continued all round. Sometimes the staves are made with holes to let in air, as well as by the spaces between the staves. These baskets pack better, particularly when the peaches are large, than the usual boxes. It was stated that a member of the society had set out 10,000 peach trees in Calhoun County, intending to can all the fruit.

FLAX AND HEMP.

S. A. Clemens, in an article on flax and hemp, states that subsequent to 1860 the high prices paid for flax-seed induced a large increase of this crop in Ohio, and its general extension in other western States, while the demand for flax-tow during the war led to an increase in the number of flax-tow mills in the West. In Ohio, Indiana, Michigan, Illinois, Wisconsin, and Iowa, there are about ninety, fully one-half being in Ohio; their aggregate capacity is given as 8,000 tons of tow annually, but 2,500 tons are named as the highest figures reached at any time. Since the war the importation of jute from India has driven western flax-tow from the market, and this foreign competition would have been fatal to the western flax-lint business but for the sale of tow to supply the small local factories, and to afford material for mixing with hemp in the rope and bagging factories of Louisville and St. Louis. The cultivation of flax for seed only, or mainly, has been greatly extended, however, now amounting to not less than 2,500,000 bushels, giving 62,500,000 pounds of fiber for the last year, of which less than 3,000,000 pounds have been saved and prepared for use, the remainder having been burned in the straw, or otherwise wasted, all for the want of a reliable market, destroyed by ruinous foreign competition. The hemp crop, which once amounted to 30,000 tons in Missouri and Kentucky, has fallen to 7,500

tons, though the crop could be returned to its former maximum by proper encouragement.

In 1865 the importation of jute and of its manufactured products reached 91,549,800 pounds. This included 6,875,215 gunny bags and 11,641,200 pounds of unmanufactured jute. Most of these products are consumed in the western States, where flax and hemp would be far more generally produced, and their manufacture into a better quality of the needed fabrics would be established, but for the competition of this flimsy India fiber, which is grown where less than ten cents a day is paid for labor. The opinion is expressed that tariff duties of two cents per pound on any form of the unmanufactured fibers of imported jute, hemp, and flax, with three cents per pound on jute butts, and four cents on the coarse fabrics of these fibers, would effectually build up these western industries.

Few cultivated plants find a wider congeniality of soil and climate than flax; and, with generous culture, it would flourish from the Gulf to the Red River of the North on clay lands and sandy loams, uplands and alluvial bottoms, timber lands and prairies. The special conditions of soil requisite are good depth, good heart, well drained by nature or art, good tilth, and free from weeds. The exceptions to this are lands of deep sandy or gravelly subsoil, in which flax will suffer in dry seasons, and in mucky or new lands, which hold an excess of vegetable mold, or are deficient in silicious matter, in which the flax, from rank growth and deficient strength of stem, will be liable to fall and lodge before maturing. Hemp culture requires a rich, kindly soil, in good heart, free of weeds, and capable of enduring extremes of wet and also dry seasons, to find which the subsoil must be examined as well as the surface, as millions of acres of fertile corn lands in the western States have surface soils entirely suited to hemp culture, but, from the retentive nature of their clayey subsoils, hemp cannot be successfully cultivated year by year, without thorough under-draining. Favorable soils are found in great perfection on the alluvial bottoms of the Mississippi and the Missouri River, and some of their branches. If the ground is rich, does not hold water standing on the surface after heavy rains, and in drought does not bake and crack, but has moist earth within two or three inches of the surface, it possesses the subsoil for hemp culture.

BROOM CORN.

In a brief chapter on broom corn it is stated that of the four or five hundred tons of broom corn used in St. Louis, only about forty tons are grown in Missouri, though it is claimed that the home product is superior to that brought from Illinois. The bottom lands of Missouri are suited to its growth, and the writer urges a larger cultivation of the crop. Land that will produce a rapid and tall growth of Indian corn will grow good broom corn. As a general thing a growth of head of from twelve to eighteen inches is the most profitable crop for manufacturers; yet for "hurl," or those brooms made from the brush, without using any of the stalk under the wire, which are the most desirable brooms, a growth of twenty to twenty-four inches is necessary. An average crop is about one-fourth of a ton per acre, worth about $150 per ton. The seed is almost equal to oats for all kinds of stock. The seeds average forty bushels to the acre, worth $30; total product of the acre, $67 50; and the labor involved will not exceed that required for an acre of Indian corn. The demand is, of course, limited, and the price of the brush will depend on supply and demand.

SHEEP HUSBANDRY IN MISSOURI.

S. P. Boardman, in an article upon this subject, claims that sheep husbandry will be found more profitable than in the eastern States, for the reasons: 1. The greater cheapness of Missouri lands. 2. Their greater fertility. 3. The less amount of labor necessary to produce an equal quantity of winter feed. 4. The greater mildness of the climate, rendering less winter feed necessary. 5. The great extent of "range" open to the use of the Missouri wool-grower for pasture. Among the incidental advantages of wool-growing is mentioned the small cost of getting to market, as two horses will walk off as easily with a thousand dollars' worth of wool as with twenty dollars worth of corn, the same difference holding good when shipped by rail. Sheep are recommended for "shrubbing out" and clearing up rough, bushy lands; as, by feeding on them in winter, they will kill alders, hazel bushes, small wild crab-trees, black berry bushes, &c. In a timber pasture they also cause the blue grass to spread much faster than other stock. Prairie grass, too, is quite easily killed out by close pasturing with sheep, which is frequently quite an advantage when one has part of his farm "lying out," and which he would like to break as cheaply as possible before fencing in.

In discussing the general management of sheep, the writer recommends tagging the whole flock before turning out on the range in the spring; and also at the same time the cutting of all long hoofs. In a flock of 1,000 or more it is better to herd the breeding ewes by themselves, particularly if compelled to raise lambs on the range. It is better, if possible, not to fold sheep, but to give them a field of considerable size in which to choose their place to lie. If lambs are to be raised on the range, it will not do, in any part of Missouri, to have them come in until the worst cold storms are past, and there is a good bite of grass. Docking and castrating should be done before the lambs are four weeks old. When herded on the prairies, early weaning is preferable; say, wean April lambs from the 10th to the 15th of August. The best method of washing, the easiest, and cheapest, and the cleanest, is by swimming them three times across a running stream, with an hour's interval between the swims. One swimming soaks the wool, and the second and third clean out the filth. When so situated as not to be able to wash by swimming, the writer prefers to shear without washing. In Missouri, sheep should be washed from the 10th of May to the 1st of June, and shearing commence in six to twelve days thereafter.

The American Merino and the Cotswold are designated, respectively, as the best representatives of fine-wooled and mutton sheep. Bucks ought to be kept by themselves the year round, except when serving ewes, which period should not exceed five weeks. Lambs, even though on good grass, should be fed much sooner in the fall than old sheep; and the latter must be fed as soon as it is found they are not doing well without feeding. Lambs must be wintered by themselves; and, when practicable, yearlings also.

PRAIRIE LANDS.

A writer, speaking in reference to what prairie lands can do, claims that prairie, broken in time and sown in the fall with wheat, is sure to yield a crop which will pay for plowing, fencing, and the cost of the land the first year. Suppose a farmer pays for forty acres, $320, call the fencing $320, labor $200, with $60 more for extras, the whole costing $900. Suppose he gets twenty bushels of wheat to the acre, equal to eight hun-

dred bushels, worth, say $1 50 per bushel, equal to $1,200, being $300 more than cost of land, fencing, labor, &c. The land will not only pay for itself the first year, but will also increase in cash value for years to come.

THE PROGRESS OF MISSOURI AND ILLINOIS CONTRASTED.

The same writer states that, in 1820, Missouri had a larger population than Illinois by 10,000, while now the latter has double the number of the former. In 1850 Missouri had $137,247,707 real valuation; Illinois $156,265,000. In 1860 Illinois had increased her valuation 475 per cent.; Missouri gained only 265 per cent. In 1860 Illinois had 13,251,473 acres of improved lands, and Missouri 6,246,871; the cash value of farms in the former was $432,531,072; in the latter $230,632,126; while the value of farming implements in Missouri was about $10,000,000 less than in Illinois; all of which the writer attributes to the difference of institutions, freedom and slavery, during the forty years included in the record, since Illinois has no advantage for which Missouri has not some compensation. Since the State pronounced for freedom, not less than 150,000 emigrants have poured in, and the tide is increasing.

THE MINERALS OF MISSOURI.

In an address upon the minerals of Missouri, it is estimated that the coal fields of the State extend over 26,880 square miles, with an average thickness of five feet of workable coal, making an aggregate store of over 134,000,000 of tons. The iron mines not only contain ores in unexampled quantities, but their ores are even more remarkable for quality than abundance; the resources are simply inexhaustible, sufficient to supply the whole Union for generations. There are now seven furnaces in the State, smelting iron ores with charcoal, and a beginning has been made in smelting with mineral coal, with entire success. Lead is found in greater or less quantity throughout the metalliferous regions of the State; and it is asserted that in no part of the world is there so large an area of lead-bearing rocks, so uniformly disposed, so regular, so readily identified, or on so grand a scale. Copper is also believed to exist in quantity, but as yet has not been developed to any great extent. Tin, cobalt, nickel, zinc, &c., exist in limited quantities.

FOREIGN EXCHANGES.

This Department recently entered upon a system of exchange with foreign governments, societies, and individuals. Brief as has been the period since this system was inaugurated, it has been attended with the most gratifying results. Correspondence has been had with the principal agricultural societies and academies of Europe, societies of natural history, horticultural societies, public libraries, and individuals well known for their attainments in agricultural science. The system has thus far met with the approval of all that practical and sagacious class of men who are the representatives of foreign agricultural interests, to whom it has been presented.

Already the increase of the library of the Department by this means has been considerable. Valuable books and periodicals, English, German, French, Spanish, Italian, Danish, and Swedish, have been added, in exchange for our own publications. Contributions to the museum have also been received. Many societies have offered to exchange vines, plants, and seeds, of various descriptions.

It is the design of the Commissioner to extend this system of exchange to embrace, if possible, all civilized countries, expecting to receive in return for the agricultural works of the Department, and valuable specimens of American growth and production, contributions of interest and value. The advantages of such a system cannot be overestimated, adding, as it does, to our own experience the practical and theoretical knowledge of other countries. It is within the scope of this design to exchange specimens of mineralogy, botany, entomology, horticulture, &c., with the confident expectation of enriching and adding to the practical value of the museum of the Department.

A few references to the manner in which the system of exchange has been received are presented:

In a communication from the central directors of the agronomical societies of the grand duchy of Posen, dated September 14, 1868, acknowledging the receipt of books and seeds from this Department, for which a suitable exchange was returned, the directors express earnestly a desire "to continue for the future and to enhance the custom so happily commenced of communicating to each other the fruits of labor upon a common field."

Alexander Buchan, secretary of the Scottish Meteorological Society, in acknowledging the receipt of reports of this Department, and communicating an offer of a set of the "Transactions" of his society, says, in relation to a system of exchange: "I am much gratified to see the activity with which you have taken up and work at this important practical problem."

James Plaisher, president of the Meteorological Society at Blackheath, England, thus writes: "In addition to the official letter sent, acknowledging the receipt of the books with which you have kindly favored the Meteorological Society, I am desirous of carrying out the wishes of the council of three by mentioning how much the interesting series of your Department publications is appreciated. Not only are there many valuable papers on general science, but there is also much meteorological

information. As president of the society, I beg to add the expression of my own satisfaction, and the great interest with which I witness the intercommunication which you have kindly suggested, and with which the Meteorological Society most gladly co-operate."

The following is an extract from a letter dated Melbourne, September 1, 1868, from George R. Latham, United States consul, to the Commissioner of Agriculture:

"I may here remark that an exchange of publications with the Agricultural Department of the United States will be appreciated by none more highly than by the scientific agriculturists of this colony. The annual reports of your Department are regarded by them as the most valuable agricultural publications in the world."

The following is an extract from a letter of M. Jules Joubert, secretary of the Agricultural Society of New South Wales, dated November 6, 1868:

"One of the most useful works we have had placed before us; and without any exception *the most* valuable to our colonists, for all matters connected with agriculture, is the report published annually by your office."

Mr. David, director of the Statistical Bureau of the kingdom of Denmark, in giving notice to Mr. Yeaman, United States minister resident at Copenhagen, of the transmission of reports of his bureau, on agricultural statistics, to this Department, expresses very warmly the "utmost interest" which he feels in making exchanges of works upon agriculture, and conveys his hearty thanks for the offer of exchange.

The meteorological committee of the Royal Agricultural Society of Great Britain has signified its appreciation of the mutual benefits of exchange by accepting the offer of this Department; and in return for some recent volumes of departmental reports, has transmitted forty-nine volumes of great interest and value, constituting a series of its own reports, with atlases. It has also signified a desire for future exchanges.

Mr. F. F. Cavada, United States consul at Trinidad de Cuba, in a letter requesting of this Department seeds of cereals, vegetables, &c., and promising others of choice varieties in return, on behalf of American citizens employed in agriculture in Cuba, speaks of the great and reciprocal benefits to be derived from such exchanges between Cuba and the United States—benefits of which this country will naturally reap the superior share.

William S. Mechling, of Belize, British Honduras, joins in the uniform recommendation of a system of exchange. As between this country and British Honduras, he expresses the opinion "that such an arrangement would be highly beneficial to both countries;" and touching the productions of Honduras, writes: "I am satisfied that I could send many rare and valuable seeds."

Dr. Jos. D. Hooker, director of the Royal Gardens at Kew, England, in sending seeds of trees gathered from the Himalayas, and acknowledging the receipt of seeds of shrubs and trees from this country, also speaks warmly of the benefits of exchange. He promises a large collection of seeds of European and Asiatic shrubs and trees, and of such seeds native here he says: "You cannot go wrong in sending them."

Eugene Schuyler, United States consul at Moscow, Russia, writes as follows:

"I inclose you a specimen of hemp, prepared by a new process, by Mr. Michael Puzanof, in the government of Kursk. I have not yet been able to learn the details of the process, but will send them to you as soon as I can procure them from Mr. Puzanof.

"Some parts of Smolensk and other western governments are very swampy, and the Prince Mestchersky has thought it would be well to try to introduce there *Zizania aquatica*, or Indian rice, which is said to be largely eaten by the Northwestern Indians. He has requested me to procure him some of the seed. Is it in your power to inclose me a package of this seed for the prince? I shall be very happy to oblige him, and am much indebted to you.

"It may interest you to know that there appeared in the February number of the Russian Messenger, the chief monthly journal here, a long and very flattering article on the Agricultural Department over which you preside."

Transmitting seeds from Asia Minor. E. J. Smithers, United States consul at Smyrna, writes to the Department as follows, under date of April 10, 1869:

"I have the honor to inform you that I have transmitted to your Department, through the United States dispatch agent at London, a small box containing three kinds of seed of the most delicious melons grown in Asia Minor. These seeds were kindly procured by his excellency Ismail Pasha, governor general of this vilayet, and forwarded to this consulate for transmission to your Department.

"I may remark in regard to these varieties of melons, that when kept in a dry place they will remain perfect till mid-winter. Especially is this the case in regard to the Magnesia and Kir Ragatch varieties. As the climate of Asia Minor is very dry after the middle of April or the first of May, until the latter part of September, I would recommend California as the most suitable section of our country for the successful cultivation of these melons."

The following is a copy of Ismail Pacha's letter to Mr. Smithers, transmitting the seeds referred to in the preceding extract:

"VILAYET OF AIDIN, *Smyrna, April* 4, 1869.

"SIR: It has been to me an agreeable duty to be able to realize your desire concerning melon seeds. I have procured three kinds, which you will receive with this letter.

"I will be happy if the committee of agriculture of the United States succeeds in the cultivation of our delicious melons in the New World, and I will feel flattered every time the eminent members of this committee require my feeble help, which will always be accorded to them so far as I am able. On their side, if they would sometimes send us seed capable of being acclimatized in these fine regions of Asia Minor, I would feel grateful.

"Please to accept, sir, the assurance of my high consideration.

"ISMAIL.

"E. J. SMITHERS, Esq., *United States Consul*."

Auguste Dupuis writes from Village des Aulnaies, L'Islet County, province of Quebec, as follows:

"You have been kind enough to send me the report for 1867. This valuable report to the agriculturists of the United States would be profitable to farmers in all parts of the world. The farmers of your beautiful country ought to be proud of being represented by men who are elevating agriculture to its proper position.

"They receive in this report lessons numerous and profitable. They can make comparisons between the methods pursued in States adjoining their own.

"You deserve much from your countrymen for this great work."

José Martinez de Hor, president of the Rural Society of the Argentine Republic, South America, writes as follows:

"It affords me pleasure to acknowledge the receipt of your esteemed favor of the 25th September, 1868, and to return you infinite thanks for the books which you have sent to this society. This courtesy has been highly appreciated, and in return you will receive, through Dr. C. H. Trumbull, the second volume of the annals of the society. We will send each year the volume containing the publications of the society, and hope to merit in return published works and reports of your Department, because of their interest to a body like ours, which has for its object the illustration and stimulation of the rural prosperity of the country.

"With great satisfaction we accept your offer to send certain seeds, &c., for trial in our soil, and are happy to respond to your invitation to send samples of the products of this country, and have already taken measures to send you a shipment in May, 1870.

"Preparations are being made for an Argentine exposition at Cordova, about the 17th of April, 1870. We shall improve that occasion to prepare a collection of all seeds considered useful or desirable for trial in the United States, and shall notify you promptly of shipment, and at the same time forward instructions in reference to their cultivation. We have assurances that a number of intelligent agriculturists are preparing, as well to exhibit their products at the exposition, as to send selected samples to your Department.

"Understanding the importance to this country of a reciprocal exchange of agricultural productions with your Department, and appreciating fully the honorable intention of your propositions, the Rural Society of the Argentine Republic acknowledges your courtesy, and salutes you with an expression of its most distinguished consideration."

Exchanges of seeds, plants, and native productions have been proposed and agreed upon between this Department and the following foreign governments, societies, and individuals:

Austria.—The Imperial Agricultural Society.

Australia.—Botanical gardens, Melbourne.

Argentine Republic.—Agricultural Society of the Argentine Republic.

Brazil.—Dr. Joseph Cooper Reinhart, Campinas.

British Honduras.—W. S. Mechling, Esq., Belize.

Bavaria.—Royal gardens of Bavaria.

Cape of Good Hope.—Cape of Good Hope Agricultural Society.

China.—The Chinese government.

Denmark.—The Statistical Bureau of Denmark.

England.—India Museum, London; Kew gardens, do.; Royal Meteorological Society, do.

France.—Jardin des Plantes, Paris.

Guatemala.—The government of Guatemala.

Japan.—The Japanese government.

Poland.—Polish Agricultural Society, Posen.

Porto Rico.—George Latimer, Esq., St. John's.

Scotland.—Scottish Meteorological Society, Edinburgh.

Spain.—Royal gardens of Madrid.

The foreign societies to which reports of this Department have been forwarded, with reference to exchange of publications, are as follows:

AFRICA.

Cape Town.—Agricultural Society.

Mauritius.—Société d'Histoire Naturelle de l'Ile Maurice.

AMERICA, EXCLUSIVE OF BRITISH AMERICA.

Bogota, New Granada.—Sociedad de Naturalistas Neo-Granadinos.
Georgetown, British Guiana.—Royal Agricultural and Commercial Society.
Havana, Cuba.—Real Sociedad Economica de la Habana.
Mexico, Mexico.—Escuela de Agricultura; Sociedad Mexicana de Geografia y Estadistica.
Rio Janeiro, Brazil.—Sociedad Auxiliadora de Industria Nacional.

ASIA.

Batavia.—Natuurkundige Vereeniging in Nederlandsch Indie.
Calcutta.—Agricultural and Horticultural Society of India.
Manilla.—Royal Economical Society of the Philippine Islands.

AUSTRALIA.

Melbourne.—Acclimatization Society; Botanic garden.
Sydney.—Australian Horticultural and Agricultural Society; Entomological Society of New South Wales.

BELGIUM.

Brussels.—Société Centrale d'Agriculture de Belgique; Société Entomologique de Belgique; Société de Flora; Société Palæontologique de Belgique; Société Royale de Botanique de Belgique; Société Royale protectrice des Animaux.
Ghent.—Société Royale d'Agriculture et de Botanique.
Namur.—Société Agricole et Forestière de la Province de Namur.

DENMARK.

Copenhagen.—Botaniske Forening; Bureau Royal de la Statistique; Danske Landmands-Forsamling. (Association of Danish Agriculturists;) Kongelige Bibliothek, (Royal Library;) Kongelige Danske Videnskabernes-Selskab. (Royal Danish Society of Science;) Kongelige Landhuusholdnings-Selskab. (Royal Society of Rural Economy;) Naturhistoriske Forening; Naturhistorisk Tidsskrift; Tidskrift for Veterinær. (Veterinary Journal;) Veterinær-Selskab, (Veterinary Society.)

FRANCE.

Association Scientifique de France.
Abbeville.—Société Linnéenne du Nord de France.
Aix.—Académie des Sciences, d'Agriculture, Arts et Belles-Lettres.
Angers.—Société d'Agriculture, Sciences et Arts; Société Linnéenne du Département de Maine-et-Loire.
Angoulême.—Société d'Agriculture, Sciences, Arts et du Commerce du Dép. de la Charente.
Bayeux.—Société d'Agriculture, Science, Arts et Belles-Lettres.
Bordeaux.—Société d'Horticulture de la Gironde; Société Linnéenne de Bordeaux.
Caen.—Société d'Agriculture et de Commerce de Caen; Société des Antiquaires de Normandie.

Chalons-sur-Marne.—Société d'Agriculture, Commerce et Sciences de la Marne.

Cherbourg.—Société Académique de Cherbourg.

Dijon.—Société d'Agriculture et d'Industrie Agricole du Département de la Côte d'Or.

Douai.—Association Vétérinaire des Départements du Nord et du Pas-de-Calais; Société Impériale d'Agriculture, Sciences et Arts de Douai.

Evreux.—Société Libre d'Agriculture, Sciences, Arts et Belles-Lettres de l'Eure.

Le Mans.—Société d'Agriculture, Science et Arts de la Sarthe.

Lille.—Société Impériale des Sciences, de l'Agriculture et des Arts.

Lyons.—Société Imperiale de l'Agriculture, Histoire Naturelle et Arts Utiles de Lyon.

Mâcon.—Académie de Mâcon: Société des Arts, Belles-Lettres et d'Agriculture.

Mende.—Société d'Agriculture, Industrie, Science et Arts du Département de la Lozère.

Metz.—Académie Impériale de Metz.

Montpellier.—Société Centrale d'Agriculture du Département de la Herault; Société Générale d'Encouragement à la Sériculture; Le Messager Agricole.

Moulins.—Société d'Horticulture de l'Allier.

Paris.—Gustave Bossange et Co.; American Library; Bibliothèque Impériale; Ministère du Commerce et Agriculture; Ministère de l'Etranger (Dép. de Statistique;) Société Botanique de France; Société Entomologique; Société Impériale et Centrale d'Agriculture de France; Société Impériale et Centrale d'Horticulture de Paris; Société Impériale et Centrale de Médecine Vétérinaire; Société Impériale Zoologique d'Acclimatation.

Puy.—Société d'Agriculture, Sciences, Arts et Commerce.

Saint Quentin.—Société Académique des Sciences, Arts, Belles-Lettres et d'Agriculture.

Strasbourg.—Société des Sciences, Agriculture et Arts du Bas-Rhin.

Tours.—Société d'Agriculture, des Sciences, des Arts et des Belles-Lettres.

Valenciennes.—Société d'Agriculture, Sciences et Arts.

GERMANY, INCLUDING AUSTRIA AND PRUSSIA.

Verein der Süddeutschen Forstwirthe; Versammlung Deutscher Land-und Forstwirthe; Versammlung Deutscher Naturforscher und Aerzte.

Agram, Austria.—K. K. Kroatisch-Slavonische Landwirthschafts-Gesellschaft.

Altenburg, Saxe-Altenburg.—Naturforschende Gesellschaft des Osterlan des Pomologische Gesellschaft.

Arolsen, Waldeck.—Landwirthschaftlicher Verein im Fürstenthum Waldeck.

Augsburg, Bavaria.—Landwirthsch. Verein von Schwaben und Neuburg; Naturhistorischer Verein; Redaction der Wochenschrift für Thierheilkunde und Viehzucht.

Bamberg, Bavaria.—Naturforschende Gesellschaft.

Berlin.—Acclimatisations-Verein für die Preuss. Staaten; Botanischer Verein für die Provinz Brandenburg, etc.; Deutsche Geologischer Gesellschaft; Entomologischer Verein; Gesellschaft für Erdkunde; Gesellschaft Naturforschender Freunde; Königliche Bibliothek; Kö-

nigliches Landes-Oeconomie-Collegium; Königlich Ministerium für Landwirthschaftl. Angelegenheiten; Meteorologisches Instit; Redaction des Archivs für Path. Anatomie; Redaction der Landwirthschaftliche Zeitung für Nord- und Mitteldeutschland; Redaction des Landwirthschaftliches Centralblatt für Deutschland; Redaction des Statistischen Central-Archivs, (Dr. O. Hübner,) Statistisches Bureau; Verein für deutsche Statistik; Verein zur Beförderung des Gartenbaues; Verein zur Beförderung des Gewerbefleisses in Preussen.

Blankenburg, Brunswick.—Naturwissenschaftlicher Verein des Harzes.

Bonn.—Landwirthschaftlicher Central-Verein für Rheinpreussen; Naturhistorischer Verein der preussischen Rheinlande und Westphalens; Niederrheinische Gesellschaft für Natur- u. Heilkunde; Redaction des Wiegmanns'chen Archivs für Naturgeschichte.

Brunswick, Brunswick.—Garten-Verein im Herzogthum Braunschweig.

Bremen.—Naturwissenschaftlicher Verein.

Breslau, Prussia.—Landwirthschaftlicher Central-Verein für Schlesien: Schlesische Gesellschaft für vaterländische Cultur; Schlesischer Verein für Berg- und Hüttenkunde; Verein für schlesische Insektenkunde.

Bregenz, Austria.—Naturforschender Verein.

Bromberg, Prussia.—Landwirthschaftlicher Central-Verein für den Netze-District.

Brünn, Austria.—K. K. Mährisch-schlesische Gesellschaft für Acker bau, Natur- und Landeskunde; Naturforschender Verein.

Chemnitz, Saxony.—Redaction der Deutschen Industrie Zeitung.

Celle, Hanover.—Landwirthschaftliche Gesellschaft.

Clempenow bei Anclam, Prussia.—Baltischer Verein zur Beförderung der Landwirthschaft.

Czernowitz, Austria.—Verein für Landeskultur und Landeskunde im Herzogthume Bukowina.

Dantzic, Prussia.—Landwirthschaftlicher Central-Verein; Naturforschende Gesellschaft.

Darmstadt, Hesse.—Gartenbau-Verein; Grossherzoglich Hessische Central-Stelle für die Landes-Statistik; Grossherzogliche Hof-Bibliothek; Mittelrheinisch-Geologischer Verein.

Deidesheim, Bavaria.—Pollichia: Naturwissenschaftlicher Verein der bayerischen Pfalz.

Dresden, Saxony.—Seine Majestät der König von Sachsen; Flora: Gesellschaft für Botanik und Gartenbau; Gesellschaft für Botanik und Zoologie; Königliche Bibliothek; Statistisches Bureau; Verein für Erdkunde.

Eldena, Prussia.—Gartenbau-Verein für Neu-vorpommern und Rügen; K. P. Staats- und Landwirthschaftl. Akademie.

Emden, Hanover.—Naturforschende Gesellschaft.

Erfurt, Prussia.—Akademie Gemeinnütziger Wissenschaften; Gartenbau-Verein.

Frankfort on the Oder, Prussia.—Historisch-Statistischer Verein.

Frankfort on the Main, Prussia.—Gartenbaugesellschaft "Flora;" Senckenbergische naturforschende Gesellschaft.

Freiberg, Saxony.—Königlich Sächsische Bergakademie.

Görlitz, Prussia.—Naturforschende Gesellschaft.

Göttingen, Hanover.—Königliche Gesellschaft der Wissenschaften.

Gotha, Saxe-Coburg.—Thüringer Gartenbau-Verein.

Grätz, Austria.—K. K. Steiermärkische Landwirthschafts-Gesellschaft; Steiermärkische Landes-Ober-Realschule.

Gumbinnen, Prussia.—Landwirthschaftlicher Central-Verein für Lit tauen und Masuren.

Halle, Prussia.—Naturforschende Gesellschaft.
Hamburg, Hanse-Town.—Stadt-Bibliothek; Thierschutz-Verein.
Hanover, Hanover.—Königliche Bibliothek; Statistisches Bureau.
Heidelberg, Baden.—Landwirthschaftlicher Bezirks-Verein.
Hermannstadt, Austria.—Verein für Siebenbürgische Landeskunde.
Hohenheim, Würtemberg.—Königlich Würtembergische Land- und Forstwirthschaftliche Akademie.
Innsbruck, Austria.—K. K. Landwirthschafts-Gesellschaft für Tirol und Vorarlberg.
Jena, Saxe-Weimar.—Landwirthschaftliches Institut; Redaction der Zeitschrift für deutsche Landwirthe; Statistisches Bureau der Vereinigten Thüringischen Staaten.
Karlsruhe, Baden.—Centralstelle für die Landwirthschaft; Grossherz. Badisches Statistisches Bureau des Handels-Ministerium; Grossherzogliche Hofbibliothek.
Kassel, Hesse.—K. Commission für landwirthschaftliche Angelegenheiten in Kurhessen; Verein für Hessische Landeskunde.
Kiel, Holstein.—Landwirthschaftlicher Generalverein des Herzogthums Holstein.
Klagenfurt, Austria.—K. K. Landwirthschafts-Gesellschaft.
Koblentz, Prussia.—Naturhistorischer Verein.
Köln, Prussia.—Landwirthschaftlicher Verein.
Königsberg, Prussia.—Centralstelle der Landwirthschaftlicher Vereine des Regierungs-Bezirks Königsberg.
Laibach, Austria.—K. K. Landwirthschafts-Gesellschaft.
Leipsig, Saxony.—Dr. Felix Flügel, (agent Smithsonian Institution;) Botanische Zeitung; Jahrbücher für wissenschaftliche Botanik; Naturforschende Gesellschaft; Redaction der Zeitschrift für deutsche Landwirthe; Verein von Freunden der Erdkunde.
Liegnitz, Prussia.—Landwirthschaftlicher Verein.
Linz, Austria.—K. K. Landwirthschafts-Gesellschaft.
Mentz, Hesse.—Rheinische Naturforschende Gesellschaft.
Marienwerder, Prussia.—Verein Westpreussischer Landwirthe.
Meiningen, Saxe-Meiningen.—Verein für Pomologie und Gartenbau.
Meissen, Saxony.—Naturwissenschaftliche Gesellschaft "Isis."
Mengeringhausen, Waldeck.—Landwirthschaftlicher Verein im Fürstenthume Waldeck.
Merseburg, Prussia.—Landwirthschaftlicher Central-Verein für die Provinz Sachsen.
München.—Baierische Gartenbau-Gesellschaft; Königl. Botanischer Garten; Königl. Statistisches Bureau; Landwirthschaftlicher Verein; Verein für Naturkunde.
Münster, Prussia.—Landwirthschaftlicher Provinzial-Verein für Westphalen und Lippe.
Neutitschein, Austria.—Landwirthschaftlicher Verein.
Passau, Bavaria.—Praktische Gartenbau-Gesellschaft in Baiern.
Pesth.—Geologische Gesellschaft für Ungarn.—Királyi Magyar Természettudományi Társulat.
Potsdam, Prussia.—Landwirthschaftlicher Provinzial-Verein.
Prague, Austria.—K. K. Patriotisch-ökonomische Gesellschaft.
Regensburg, Bavaria.—K. Baierische botanische Gesellschaft.
Rostock, Mecklenburg.—Mecklenburgischer Patriotischer Verein.
Salzburg, Austria.—K. K. Landwirthschafts-Gesellschaft.
Schwerin, Mecklenburg-Schwerin.—Grossherzogliche Landes-Vermessungs-Commission; Grossherzogliches Statistisches Bureau.
Sigmaringen, Prussia.—Landwirthschaftliche Centralstelle des Vereins

zur Beförderung der Landwirthschaft und der Gewerbe für die Hohenzollernschen Lande.

Sondershausen, Schwarzburg-Sondershausen.—Verein zur Beförderung der Landwirthschaft.

Stettin, Prussia.—Entomologischer Verein.

Stuttgart, Würtemberg.—Gartenbau-Gesellschaft "Flora;" Gesellschaft für die Weinverbesserung in Würtemberg: K. Centralstelle für Gewerbe und Handel; K. Centralstelle für die Landwirthschaft; K. Oeffentliche Bibliothek; K. Statistisch-topographisches Bureau; Redaction des "Thiergarten." (Dr. B. F. Weinland.)

Tharand, Saxony.—Königlich Sächs. Akademie für Forst und Landwirthe.

Trieste, Austria.—Gartenbau-Gesellschaft des Litorale.

Tübingen, Würtemberg.—Landwirthschaftlicher Verein.

Vienna, Austria.—Comité der Allgemeinen Versammlung von Berg und Hüttenmännern; Entomologischer Verein: K. K. Central-Anstalt für Meteorologie und Erd-Magnetism; K. K. Direction des Administrativen Statistik; K. K. Gartenbau-Gesellschaft: K. K. Geologische Reichsanstalt; K. K. Landwirthschafts-Gesellschaft; K. K. Statistische-Central-Commission.

Weimar Saxe-Weimar.—Verein für Blumistik und Gartenbau.

Wiesbaden, Nassau.—Verein für Naturkunde; Verein Nassauischer Land- und Forstwirthe.

Würzburg, Bavaria.—Physikalisch-Medicinische Gesellschaft.

GREAT BRITAIN AND IRELAND.

Bath.—Bath and West of England Agricultural Society.

Belfast.—Chemico-Agricultural Society of Ulster.

Cork.—Cuvierian Society.

Cirencester.—Royal Agricultural College.

Dublin.—Chemical Society of Dublin; Natural History Society of Dublin; Royal Geological Society of Ireland.

Edinburgh.—Botanical Society; Caledonian Horticultural Society; Highland and Agricultural Society of Scotland.

Keighley.—Keighley Agricultural Society.

Kew.—Library of Kew Garden.

London.—William Wesley, (agent Smithsonian Institution;) Acclimatization Society; Annals and Magazine of Natural History; British Association for the Advancement of Science; Chemical Society of London; Entomological Society; Geological Society of London; Linnæan Society; Museum of Practical Geology; Royal Agricultural Society of England; Royal Botanic Society; Royal College of Veterinary Surgeons; Royal Geographical Society of London; Royal Horticultural Society of London.

York.—Yorkshire Agricultural Society.

GREECE.

Athens.—Observatory.

HOLLAND.

Amsterdam.—Koninklijke Akademie van Wetenschappen, (Royal Academy of Sciences;) Koninklijk Zoologisch Genootschap "Natura Artis Magistra," (Royal Zoological Society;) Stadsbibliotheek, (City Library;) Vereeniging voor Statistiek in Nederland, (Statistical Association of the Netherlands.)

Arnhem.—Vreind van den Landman.

The Hague.—Bureau de la Statistique; Koninklijke Bibliotheek, (Royal Library.)

Groningen.—Genootschap ter Bevordering der Natuurkundig Wetenschappen, (Society for the Advancement of Natural Sciences.)

Harlem.—Hollandsche Maatschappij der Wetenschappen, (Society of Sciences of Holland.)

Leyden.—Nederlandsche Entomologische Vereeniging, (Entomological Society of the Netherlands:) Rijk's Museum van Natuurlijke Geschiedenis, (National Museum of Natural History;) Vereeniging voor de Flora van Nederland; University Library.

Rotterdam.—Bataaîsch Genootschap der Proefondervindejijke Wilsbegeerte, (Batavian Society of Experimental Philosophy.)

Utrecht.—Koninklijk Nederlandsch Meteorologisch Instituut.

Zwolle.—Overysselsche Vereeniging tot Ontwikkeling van Provinciale Welvaart, (Overyssel Society for Promotion of Provincial Welfare;) Vriend van den Landman.

ITALY.

Bologna.—Società Agraria della Provincia di Bologna.

Florence.—Academia Economico-agraria dei Georgofili.

Milan.—Associazione Agricola Lombarda di Corte del Palasio; Reale Instituto Veterinario.

Naples.—R. Orto Botanico di Napoli.

Palermo.—R. Istituto d'Incorragiamento di Agricoltura, Arti e Manifatture in Sicilia; Società di Acclimazione e di Agricoltura in Sicilia.

Pesaro.—Accademia Agraria di Pesaro.

Turin.—Accademia Reale di Agricoltura; Bureau Royale Statistique; Ministero di Agricoltura, Industria e Commercio.

Udine.—Associazone Agraria Friulana.

Verona.—Accademia de'Agricoltura, Commercio ed Arti di Verona.

NORWAY.

Christiania.—Physiographiske Forening.

Drontheim.—Kongelige Norske Videnskabernes-Selskab, (Royal Northern Society of Science.)

POLYNESIA.

Honolulu, Sandwich Islands.—Royal Hawaiian Agricultural Society.

PORTUGAL.

Lisbon.—Academia Real das Sciencias.

RUSSIA.

Dorpat.—Dorpater Naturforscher-Gesellschaft.

Helsingfors.—Magnetisches und Meteorologisches Observatorium; Societas Scientiarum Fennica.

Moscow.—Imper. Obshtshestvo Selskago Khozaistva, (Imperial Agricultural Society;) Société Impériale des Naturalistes de Moscou.

Odessa.—Glavnoé Outchilitché Sadovodstva, (Central Horticultural School;) Obshtshestvó Seljskagó Khozjaistva Joujnoi Rossii, (Society of Rural Economy of Southern Russia.)

Riga.—Gesellschaft Praktischer Arzte; Naturforschender Verein; Technischer Verein.

St. Petersburg.—Entomologische Gesellschaft; Kais. Russ. Mineralogische Gesellschaft; Statistitsheskii Tsentralnii Komitet, (Central Statistical Committee.)

SCANDINAVIA.

Skandinaviske Naturforskeres Forsamling, (Scandinavian Association of Naturalists.)

SPAIN.

Barcelona.—Real Academia de Buenos Letras de Barcelona.
Madrid.—Real Academia Española Archeologia y Geografia; Real Academia de la Historia.

SWEDEN.

Lund.—Physiographiske Forening, (Physiographic Association.)
Stockholm.—Bureau Central de Statistique de Suède; Bureau de la Recherche Géologique de la Suède; Kongliga Landbruks-Akademien, (Royal Academy of Agriculture;) Kongliga Svenska Vetenskaps-Academien, (Royal Swedish Academy of Sciences.)
Upsala.—Kongliga Vetenskaps-Societeten, (Royal Society of Science.)

SWITZERLAND.

Basel.—Naturforschende Gesellschaft.
Bern.—Naturforschende Gesellschaft; Ökonomische Gesellschaft des Kantons Bern.
Chur.—Naturforschende Gesellschaft Graubündens.
Geneva.—Institut National Genèvois; Observatoire; Société Genèvoise d'Utilité Publique; Société de Physique et d'Histoire Naturelle; Société Ornithologique Suisse.
Neufchatel.—Société des Sciences Naturelles.
Sion.—Société Valaisanne des Sciences Naturelles.
Zürich.—Bureau Central Météorologique Suisse; Naturforschende Gesellschaft.

OUR INDUSTRIAL COLLEGES.

The last Annual Report of this Department contained a brief abstract of all attainable information relative to the Industrial Colleges which had been organized under the act of Congress donating lands for their encouragement and support. In that preliminary history was traced the progress of public sentiment, and of the efforts made in some of the States to promote the interests of those engaged in agriculture, especially of the efforts to awaken a desire for a more intelligent preparation for the vocation of the farmer. It is gratifying to learn that several States, which had hitherto done no more than to accept the grant, have taken preparatory steps, during the past year, toward establishing agricultural colleges, either by making sale of lands alloted to them, or by organizing boards of trustees, and commencing the erection of the necessary buildings. Colleges already organized, and those in which a course of study has been marked out, have manifested a desire to perfect their plans, and to render the institutions more complete and useful. While these institutions are thus giving evidence of progress, there has been exhibited, on the part of the public, a demand for such instruction as they are fitted to impart. Although these colleges are still in their infancy, their courses of study but imperfectly matured, their boards of instruction filled only in part, and in some instances by a temporary provision of teachers, and although they are not yet provided with suitable conveniences for students, still the attendance has been large, and the students have made gratifying progress in the branches to which they have given attention.

It is proposed to give such additional information as this Department has been able to procure; and the subject will be recurred to from year to year, until the colleges are all organized, and a list of the faculty and the course of study in each can be given. This will be done because it is believed that these institutions will become co-laborers with this Department in elevating the vocation of the farmer, and giving him scientific as well as practical instruction in his pursuits.

CONNECTICUT.

The object aimed at in the Sheffield Scientific School, in its "Course of Agriculture," is to prepare the student for the successful management of a farm, by putting him in possession of a knowledge of the most approved methods of culture at present employed, and by explaining the reasons for these methods. This course is adapted to those who are already familiar with the employments of the farm. Lectures are given on the theory and practice of agriculture in all its branches, on chemistry, botany, geology, zoology, and free-hand drawing. Horticulture and forestry receive particular attention. Excursions under the direction of the professors are made useful to the students in the observation of plants and insects useful or injurious to the farmer. The course of agricultural instruction is under the direction of Professors Brewer and Johnson. The governing board of the Sheffield Scientific School consists of President Woolsey, Professors Dana, Norton, Lyman, Silliman,

Whitney, Brush, Gilman, Johnson, Brewer, Eaton, Marsh, and Verrill. They believe it to be more serviceable to the State and the country to maintain a high grade of scholarship, and say: "We cannot expect to equal the special schools of agriculture in the very desirable work of training practical farmers, though we hope, by the prosecution of the science of agriculture, and by the training of scientific professors and agriculturists, to contribute to the progress of agriculture."

ILLINOIS.

The last annual report of the Department of Agriculture contains an account of the liberal provision made for the Industrial University of this State. The legislature, on the 29th of March last, passed an additional act, making provision for the benefit and completion of the institution. Sixty thousand dollars were appropriated for this purpose, as follows: To the agricultural department, for the erection of barns, houses for farm laborers, for fencing and draining, teams, tools, fruit trees and forest trees, and stock of several breeds and varieties, $12,500 annually for two years; to the horticultural department, including buildings and structures, house for the gardener, tool-house, fencing and underdraining, fruit trees, shrubs, and plants, $10,000 per annum for two years; to the chemical department, $5,000; and for other apparatus, and for books, $10,000.

This appropriation indicates the appreciation, by the people of the State, of the importance of the new university, and augurs well for its future prosperity and usefulness.

KANSAS.

Professor John S. Hougham has been called to the chair of agricultural science in the college at Manhattan. He had previously taught agricultural chemistry in Franklin College, Indiana, for several years. Eighty acres of the farm have been inclosed by a substantial stone fence, and about half the inclosed land was under cultivation during the last summer. An orchard, embracing sixty-three varieties of fruit, has been planted. One-fourth part of the land under cultivation will be planted and tilled under the special direction of Professor Hougham, and it is expected that an illustration will thus be afforded to the students of the best methods of culture in the various departments of farming, gardening, and horticulture. Miniature farming by the students will be encouraged under his direction, each bestowing his particular attention on the portion allotted to him, careful records of which will be preserved.

One hundred and sixty-eight students have been in attendance during the year, seventy-one of whom were ladies. The institution has already furnished eighty teachers for the schools of the State.

MAINE.

The farm connected with the College of Agriculture and the Mechanic Arts is situated in a populous county, and near the geographical center of the State. It has a sufficient diversity of soil and aspect to render it suitable for experimental purposes. It is especially suited to fruit-culture and horticulture. The dormitory building has been completed, the rooms of which are large and well ventilated. A chemical laboratory, modeled after that at Brown University, has been erected, and, when completed, will afford superior facilities for instruction in

analytic chemistry, and its application to agriculture and the industrial arts. Professor Fernald, a graduate of Bowdoin College, has been elected professor of mathematics, and has entered upon the duties to which he has been assigned. Samuel Johnson, also a graduate of Bowdoin College, has been appointed farm superintendent. Thirteen students have received instruction who, during the hours allotted to labor, have rendered valuable assistance in grading the grounds and in farm work. One-fourth to one-half the expenses of the students has been defrayed from the avails of their labor.

In arranging the course of study two leading ideas are kept in view; first. to prepare the students to become good citizens by a right moral and intellectual, and social training; and, secondly, to attend to "those branches of study which are directly connected with the various industries which form the basis of the wealth and prosperity of the State." The trustees intend that the instruction given shall be "of such a character as to secure to the student the discipline of mind, and the practical experience necessary for entering upon other callings." It will be a special object of the trustees to counteract the increasing disinclination towards manual labor, and to vindicate its dignity by showing that it is compatible with intellectual culture and social refinement.

The course of study will occupy four years. Its essential features are indicated by the following outline: "English language and literature, mathematics, including trigonometry, surveying, civil engineering, drawing, chemistry, animal and vegetable physiology, botany, horticulture, the veterinary art, entomology, stock-breeding, book-keeping, history, and moral and intellectual philosophy. The French and German languages will also be taught."

The act of the legislature organizing the college requires the trustees to "encourage and, with reference to other exercises, to require all the students to engage in actual labor upon the lands and in the work-shops with which the college may be furnished, and shall provide suitable oversight and direction in such labor, so that they may become habituated to skillful and productive industry." It will thus be seen that the charter makes provision for labor, and that the trustees intend to combine practice with theory—manual labor with scientific culture. They desire "to preserve habits of industry where they exist, and to encourage students to form them where they do not exist."

Tuition and room-rent are free to all students from the State.

MASSACHUSETTS.

During the first twelve months from the opening of the college, ninety-six students were admitted on written examinations, seventy-four of whom were acquainted with farm-work. Their average age was eighteen years. The college-farm, consisting of four hundred acres, is well adapted to the uses of the institution, containing a diversity of soil and aspect, and is well fitted for farm-culture, for forestry, for the formation of plantations of fruit trees and forest trees, for the cultivation of botanical plants, and for horticulture. On a portion of it, an arboretum will be planted, in which all the varieties of trees suited to the climate will be grouped according to their natural affinities, and the principles of landscape gardening. Professor Snell, who temporarily, during the last year, gave instruction in mathematics with entire acceptance, now gives place to a permanent professor in that department, Mr. S. F. Miller, who is a graduate of Amherst college, and who has had several years' experience as a civil engineer. Mr. C. A. Goessmann, a graduate of the

University of Göttingen, has been appointed professor of chemistry. Hon. C. L. Flint lectures on dairy-farming; Dr. Calvin Cutter, on the laws of health; Dr. J. H. Stickney, on the diseases of domestic animals; Dr. Jabez Fisher, on market-gardening; Dr. Edward Hitchcock, on comparative anatomy; and Hon. Marshall P. Wilder, on the culture of fruits and flowers. Hon. Levi Stockbridge is farm-superintendent and instructor in agriculture; and President Clark is also professor of botany and horticulture, and director of the botanic garden.

The annual report made to the legislature of the State represents that there is an abundant demand for the education which this institution is designed to afford. The students have manifested a deep interest in their studies, and their progress has been commendable. It is highly desirable that students should pursue and complete the regular course of study; but provision is made for those who choose to follow a select course adapted to their circumstances and necessities.

MICHIGAN.

The last year was a prosperous one for the State Agricultural College, at Lansing. The number of students was eighty-two, representing twenty-six counties of the State. Sixty of the number were sons of farmers. Three hundred and fifty acres of the farm are now cleared, and a large part freed from stumps. Roads and fences have been built, and a large amount of grading and ditching has been done. The organic law of the college says: "Three hours of each day shall be devoted by every student of the college to labor upon the farm, and no person shall be exempt except for physical disability." The officers of the college personally superintend the work, and illustrate in the garden or the field the principles learned from the books. The junior class work, during their entire year, under the direction of the professor of practical agriculture, and the sophomores work under the professor of botany and horticulture; The students do not find the labor irksome, but are interested by its variety and its relation to their studies. They have actual practice in the laboratory, in the use of the compass and level, in grafting and budding fruit trees, and in the work generally of the garden and the farm. The trustees regard the labor system as succeeding better every year.

The lands donated by Congress, and which are located within the bounds of the State, are now in the market, but no income from this source has yet been received. It has, thus far, been supported by the State. The minimum price of the lands, established by law, is $2 50 per acre. When the sale is effected, a large fund will be created, which will greatly aid the college in giving increased facilities for instruction.

The faculty of instruction is constituted as follows: T. C. Abbott, president, and professor of mental philosophy and logic; Manley Miles, professor of animal physiology and practical agriculture, and superintendent of the farm; R. C. Kedzie, professor of chemistry; W. W. Tracey, professor of botany and horticulture, and superintendent of the gardens; George T. Fairchild, professor of English literature.

Several years' experience in giving instruction in the State Agricultural College has convinced its officers that a "defined course of study should be insisted upon." Students are not permitted to leave, at will, a study half-completed. At the same time various courses of study are presented to them, agreeing in the main, yet sufficiently divergent to meet the wants of those who have in view particular departments of labor in future life. A regular course of study extends through four years. It embraces a wide range of study and inquiry, and appears to

be well adapted to promote the ends which the institution has in view. It embraces the following departments:

Chemistry.—The elementary forces—heat, light, electricity, &c.; the laws of chemical combination; elementary substances, their history, properties, combinations, and uses; application of chemistry to the arts, analysis of soils, minerals, and manures; use of the blowpipe. In the study of analytical chemistry, the student spends three hours daily in the laboratory, under the direction of the professor of chemistry, securing in this manner a practical knowledge of the science. In agricultural chemistry, instruction is given on the formation of soils; the relation of air and moisture to vegetable growth; the nature and sources of food for plants; preparation of manures, with their application to soils.

Practical agriculture.—Laying out farms, arrangement of farm-buildings, farm implements, general principles of tillage, construction of drains, principles of stock-breeding, breeds of domestic animals, succession of crops, management of grass lands, care of animals and principles of feeding, fattening of animals, management of sheep.

Botany.—Physiological and systematic, the geographical distribution of plants, and their relative importance; the genera and species of those having agricultural, commercial, medical, or ornamental value, and those which are noxious or detrimental. Living specimens are dissected by the students, and the structure of plants is illustrated by diagrams and by the use of the microscope.

Horticulture.—The sophomore class is occupied during the year in the gardens and college grounds, and have ample opportunity to apply the instruction received in the class rooms.

Animal physiology.—Particular attention is paid to the anatomy and physiology of domestic animals, and the course of instruction is illustrated by anatomical preparations and diagrams.

Entomology.—The course in this department is illustrated by a valuable collection of native and of exotic insects. Special attention is paid to the study of species injurious to vegetation, and the best methods of checking their ravages.

Mathematics and civil engineering.—The course in this department embraces all those studies which prepare the student for the successful practice of surveying, leveling, bridge and road building, including field practice, under the supervision of the professor.

English literature.—The course of instruction is by text-books and lectures, and is intended to be of such a character as will give the students an enlarged acquaintance with the best writers in the language, and fit them for the reputable performance of the duties which will devolve upon them in their future life.

MINNESOTA.

Some steps have been taken toward organizing the agricultural college. A farm has been purchased near the college buildings, which will be inclosed during the coming season. A plan of organization is now being prepared by the trustees, who will also report a course of study to be pursued in the institution.

NEW HAMPSHIRE.

The New Hampshire College of Agriculture and the Mechanic Arts, established in 1866, was opened to students in September, 1868. It has two terms, corresponding with the fall and the spring term of Dart-

mouth College, thus giving opportunity to students to spend the summer months at home in agricultural or mechanical employment. Topics are given to them at the close of the spring term, on which papers are to be prepared, from observation, experiment, or study, for the fall term. Farmers can thus give to their sons facilities for education in the most favorable seasons for study, and still enjoy the advantage of their services in the period of greatest agricultural activity.

Candidates for admission must be sixteen years of age, and pass a satisfactory examination in the branches of English study taught in common schools.

The course of study embraces three years: the first including mathematics, botany, physical geography, chemistry, physics, and book-keeping; the second, trigonometry, practical botany, organic and analytical chemistry, history, rhetoric, mensuration, zoology, geology, and mineralogy: the third, agricultural chemistry, zoology, astronomy, and meteorology, rural economy, political science, and intellectual and moral philosophy.

The library contains five hundred volumes of scientific works, purchased in Europe, about one hundred of which are from the private library of the late Professor Faraday. Students have access to the college library, cabinets, observatory, and gymnasium. A State museum of general and applied science is proposed in connection with the institution. There are twelve free scholarships, covering the charge for tuition, one for each senatorial district. Tuition is fifteen dollars per term. The number of students in the first, or junior class, is ten.

The faculty consists of President Smith, and Professors E. W. Dimond, (agricultural chemistry,) T. R. Crosby, (animal and vegetable physiology,) D. J. Noyes, E. D. Sanborn, C. A. Young, E. T. Quimby, C. H. Hitchcock, and C. F. Emerson.

NEW YORK.

The Cornell University, the institution which received the congressional grant, was opened for the reception of students in September, 1868. No doubt is entertained that the expectations of the public, regarding the usefulness of this institution, will be fully realized. The board of instruction has been filled, in part, with professors of a high reputation, and an able corps of non-resident professors has been appointed, who will deliver courses of lectures on the subjects assigned them. The munificent endowment of its founder, the Hon. Ezra Cornell, with the princely addition of the congressional grant of lands, enables its trustees to open the institution with the fairest prospects of success and usefulness.

The faculty of the agricultural department of the university includes President A. D. White, and Professors G. C. Caldwell, B. G. Wilder, A. N. Prentiss, James Law, C. F. Hartt, and J. S. Gould.

In this department there are three courses of study, one of which requires four years for its completion, and entitles the student to the degree of bachelor of science; the other two are abridged courses, one of three and the other of two years, comprising all, or nearly all, the agricultural instruction given in the full course.

The requirements for admission to the first two of these courses are the same as for admission to the freshman class in the scientific course, namely, a good, sound English education, including algebra to quadratics; for admission to the third course of two years, a knowledge of algebra will not be insisted upon.

If any one should wish to attend one course or more of lectures in the department, and work in the laboratories or the garden, or on the farm, under the direction of the respective professors in charge, he may be permitted to do so, at the discretion of the faculty of the department. Of such a student it will be required that he pay the usual tuition fee of ten dollars, and also that his time be as fully occupied in study and work as that of other students.

In the instruction given, both laboratory and field practice are combined with the usual lecture-room work, to the utmost extent possible; to this end, land, laboratories, live stock, tools, models, and apparatus are supplied. With the aid of these appliances and means of illustration, and his own powers of observation, intelligently directed by his teachers, the student may become familiar with the chemical properties and relations of the substances composing soils, plants, and animals, with the domestic plants and animals themselves, and their conditions of health and disease, and with the best methods of agricultural practice.

PENNSYLVANIA.

An entire change in the faculty of the Agricultural College of this State has recently been made. It is thought that, after a long struggle against adverse circumstances, the college is now in a position to effect the great objects for which it was established. Thomas H. Burrowes has been appointed president, and, in an address issued to the public, he says: "Each student shall be made to know thoroughly what he studies; he shall have the opportunity to acquire an education equal to any attainable elsewhere: he shall be prepared, as far as depends on careful instruction, properly to perform his duties as a citizen, and shall be informed in the principles of our common Christianity." He also sets forth the general principles of the course of instruction which will be pursued.

RHODE ISLAND.

Brown University has received the land grant for industrial colleges, and made provision for a course of scientific and practical instruction, extending through a period of three years. The first year embraces chemistry, physiology, geometry, and algebra, as required studies; and civil engineering, analytical chemistry, or the French language, as optional studies; the second, natural philosophy and rhetoric, with applied chemistry and civil engineering, at the option of the student; the third, moral philosophy, political economy, and geology, with the same optional studies as for the second year.

The requirements for admission include a knowledge of arithmetic, algebra, English grammar, and modern geography. Provision will also be made for lectures, especially during the winter months, embracing, among other subjects, the following: The action of air and water upon soils; the influence of drainage and a proper degree of pulverization: the preparation, application, and office of manures and other fertilizers; the elements which enter into the composition of vegetables; the form in which they are presented to the growing plant: the varying proportions in which they are required by different crops; the laws of climate, and the influence of situation and exposure; modes and principles of culture; noxious insects, and the means of their destruction; the general principles of metallurgy; bleaching, dyeing, and calico printing; principles of warming, draft, and ventilation; the composition and properties of mortars and cements; composition and properties of oils, paints, and

varnishes; the manufacture of chemical re-agents; the art of kyanizing wood, and of preserving meats, fruits, and vegetables from decomposition.

WISCONSIN.

In our last Annual Report was given the course of instruction pursued in the college of this State, and annexed is a list of the faculty of instruction in the department of agriculture: Paul A. Chadbourne, president; W. W. Daniels, professor of agriculture; John C. Davies, professor of chemistry and natural history; Addison E. Verrill, professor of comparative anatomy and of entomology.

The lands granted by Congress have been located, but are not yet sold. The college is now in operation as a branch of the University of Wisconsin, and has the benefit of a farm purchased for it by the citizens of the State, at a cost of forty thousand dollars. The course of study is so arranged that instruction in the class-room can be completed in a single year "by students already well acquainted with the physical sciences, while an opportunity will be given to those who desire it for extended laboratory practice, for a higher course in botany, and for instruction in conducting experiments in agriculture and horticulture, thus making a full three years' course of study."

A wide range of optional studies is given in this department in order that the students may combine thorough mental discipline with theoretic and practical knowledge of the relation of science to agriculture.

It will be the endeavor of the professors to modify their course of instruction so as to meet the wants of the people. Lectures are given by the president and resident professors, and also by non-resident professors, on subjects calculated to illustrate the studies and promote the intellectual and moral advancement of the students.

MASSACHUSETTS AGRICULTURAL COLLEGE.

W. S. Clark, President of the Massachusetts Agricultural College, supplies the following facts in relation to the history and present status of that institution:

HISTORY.

In the year 1850 ex-Governor Levi Lincoln, on behalf of the Worcester County Agricultural Society, of which he was then president, presented to the legislature of Massachusetts a memorial upon the subject of agricultural education. While admitting that much had been done to improve the modes of cultivation and increase the products of the farm, he says: "The advance has yet been rather experimental and fortuitous than systematic, scientific, and instructive. The deep want of the husbandman is instruction in those elementary principles which give the impress of mind to his occupation. * * * Let agriculture be raised to the dignity of a profession rather than regarded as the destiny of condition, and the labor of man will be profited as largely as the character of society will assuredly be improved."

In the same year, Hon. Marshall P. Wilder, then president of the Massachusetts Senate, introduced a series of resolves concerning the establishment of an agricultural school. These resolves authorized the governor to appoint a board of commissioners to prepare a plan for such

PLATE XIX.

MASSACHUSETTS AGRICULTURAL COLLEGE, AMHERST, MASS.

a school or college, and to select and obtain by gift or purchase a suitable farm, and appropriated fifteen thousand dollars to defray necessary expenses. The senate passed the resolves unanimously, but the house of representatives failed to concur. Nevertheless, a board of commissioners was appointed, of which Mr. Wilder was chairman, to consider the subject and report to the legislature of 1851. Dr. Edward Hitchcock, a member of the board, visited the agricultural schools of Europe, and made an elaborate report concerning them. The report of the commissioners recommended the establishment of an agricultural college with a model and experimental farm, and also a State board of agriculture. As the latter required but a small appropriation, and might be useful in preparing the way for the former, it was organized in the year 1851.

This board consists at present of one delegate from each of the incorporated agricultural societies of the State, three members at large, appointed by the governor, and, as members *ex officio*, the governor, lieutenant governor, secretary of state, and the president of the agricultural college. The number of societies has gradually increased, until now there are thirty, and the board therefore contains thirty-seven members. Under the efficient management of its excellent secretary, C. L. Flint, this board has greatly benefited the agricultural interest of the Commonwealth, and its annual reports have been eagerly sought and highly valued by the farmers of Massachusetts, as well as by the intelligent friends of progressive agriculture throughout the country. By the inducements offered for the organization of societies and annual exhibitions of agricultural implements, stock, and produce of all kinds; by the aid afforded to such as were willing to form farmers' clubs for mutual improvement; by the publication and distribution of useful information upon a great variety of practical topics; and especially by a constant effort to awaken in the public mind an interest in the subject of agricultural education, the object for which the board was established has been most successfully accomplished.

In the year 1856, members of the board procured an act of incorporation as the Massachusetts School of Agriculture, which would probably have gone into operation in Springfield, in 1862, but for the breaking out of the war.

The legislature of 1863 accepted the liberal grant of Congress of 360,000 acres of public land, and established with the proceeds of the sale of nine-tenths of it a fund for the promotion of education in agriculture and the mechanic arts. In accordance with the provisions of the act of Congress, one-tenth of the scrip was sold, and the proceeds used for the purchase of a model and experimental farm. A commissioner was appointed for the sale of the scrip, and the first 36,000 acres sold for the sum of $29,778 40, or about eighty-three cents per acre. The remaining 324,000 acres were sold for an average price of about sixty cents per acre; and the total fund now in the State treasury, derived from this source, amounts to $207,424 65. This is invested as follows: United States bonds, $80,500; Massachusetts bonds, $27,000; bonds of cities and towns, $94,200; and cash in treasury, $5,724 65. By the provisions of the land-grant act, the State is required to maintain forever the integrity of this fund, and to pay not less than five per cent. annual interest to the institutions selected to teach such branches of learning as are related to agriculture and the mechanic arts. After thorough discussion, the legislature decided to establish the Massachusetts Agricultural College as an independent institution, and to endow it with two-thirds the income of the above fund, while the remaining third was given to the

Institute of Technology, which had already begun operations in the city of Boston, with the special object of teaching science in its applications to the useful arts.

The college charter was approved April 29, 1863. Its most important provisions are as follows:

First. The board of trustees shall consist of fourteen members, elected by the legislature for life, or until removed for cause. Of the original board, one member was selected from each county of the State, and vacancies have usually been filled by the legislature upon this principle. The governor, lieutenant governor, secretaries of the boards of education and agriculture, and the president of the college faculty, are members *ex officio*.

Second. The college shall have a farm of not less than one hundred acres, for experimental and other purposes, and shall make suitable arrangements for manual labor by the students.

Third. The location of the college is made dependent upon a subscription of $75,000 for the erection of buildings.

Fourth. The location, plan of organization, and course of study are made subject to the approval of the legislature; but by a subsequent act they were submitted to the decision of the governor and council.

Finally. By an act approved May 26, 1866, the board of agriculture was made a board of overseers of the agricultural college, with advisory and visitorial powers, but with no authority to interfere directly with the trustees in the management of the institution. They were also authorized to transfer their valuable cabinet and library from the state-house to the college, and to hold their meetings in Amherst instead of Boston.

The secretary of the Board of Agriculture is also secretary of the college, and one of its regular lecturers. The cabinet, which illustrates admirably the geology and natural history of the State, has been removed to the college, and the board holds one of its two annual meetings in Amherst. An examining committee, of which Prof. Agassiz is the present chairman, attends the closing exercises of each term, and reports annually to the board upon the condition of the institution.

LOCATION.

The trustees, with the approval of the governor and council, purchased, in the autumn of 1864, a tract of land in the valley of the Connecticut, in the midst of the best farming district of the Commonwealth, containing three hundred and eighty-three and one-half acres, and situated in the towns of Amherst and Hadley. The portion in Hadley, comprising about one hundred acres, is low, level land, bounded on the west by Mill River, and covered originally with heavy timber. The soil is black and rich, but requires drainage for profitable cultivation. At present about fifteen acres are in wood, principally white and yellow pine and oak, and the rest is used for pasturage. From this level tract the land gradually rises toward the east, until in about the center of the estate it reaches an elevation of one hundred feet above the stream on the west line. From this central ridge there is a gentle slope to a rivulet which, entering the farm on the south line, runs north to the center, when it turns at right angles and flows through a beautiful wooded ravine due west to Mill River. From this rivulet, now named Bucolic River, the land rises to the wooded summit of Mount Pleasant, near the east line, which reaches an elevation of nearly three hundred feet above the western portion of the property. From a prospect tower upon this eminence, the beholder may survey every portion of the college estate, and looking to the west,

across the valley, he sees two miles distant the granite peak called Mount Warner, whose base is washed by the transparent waters of the Connecticut. Then following with his eye the circuitous course of the river as it winds through the broad and fertile meadows from the north, he sees the red sandstone bluff called Sugar-loaf standing like a sentinel on the plain, while twenty miles away the horizon is bounded by the wooded slopes of the Green Mountain range. Directly north from the point of view is a group of rounded, conglomerate peaks, covered with timber, the highest, Metanampe, rising twelve hundred feet above the sea level, and distant about six miles from the college. The eastern view is bounded by a ridge of metamorphic character, which having been stripped of its woody mantle has become dry and unproductive. Looking southward, the spectator beholds the steep, rocky sides of the trap range, which beginning here runs south through Connecticut to New Haven.

This remarkable variety of geological formation admirably adapts the situation for the study of natural science. Along the river are found fossil fish, plants, and foot-marks of nearly two hundred species; and within a few miles of Amherst are mines of lead and baryta, where occur a large number of interesting minerals. The soil of the central ridge of the estate is a fine sandy loam of excellent quality, adapted to the cultivation of tobacco, corn, and broom-corn, or to the crops of the market gardener. The eastern or Mount Pleasant ridge is crowned by a splendid grove of large trees of many different species, as chestnut, oak, birch, pine, and hemlock. The land is somewhat stony, with gravelly subsoil, and is specially suited by its aspect and elevation for fruit culture and the uses of the arboretum, nursery of fruit and ornamental trees and shrubs, and botanic garden, to which it is devoted. From a reservoir upon this ridge an abundant supply of excellent water is distributed to the buildings and grounds.

The report of the trustees to the governor and council upon the subject of location says:

"Amherst is the center of a great agricultural region of native New England farmers, who will sympathize with the pursuits of the students; where men live and thrive by fair farming, with no side business of trade or manufactures; where students will find agriculture a respectable and paying business, instead of seeing it, as in some parts of the Commonwealth, despised by the poor, and the expensive pastime of the rich."

BUILDINGS AND ENDOWMENT.

The institution has received from the United States $168,000; from the town of Amherst, $75,000; from the State of Massachusetts, $120,000; and from different individuals, $25,000; amounting in all to the sum of $388,000.

This has been applied to meet the wants of the college, as follows, viz: A model and experimental farm of 384 acres has been purchased for $37,500. The buildings now on the estate have cost in the aggregate about $160,000. There are two brick dormitory buildings, each one hundred by fifty feet, and together accommodating in an excellent manner, as at present arranged, one hundred and ten students. Two students occupy a suite of rooms, having a study in common, and a bedroom and closet for each. There are seven dwelling-houses, one of which is a large boarding-house; three are occupied by professors, one by the farm superintendent, and the others by employés of the college. College

Hall is a large building, about one hundred by sixty feet, containing in the upper story a fine armory and drill hall for the military department. The second story is devoted to the departments of chemistry, physics, and engineering. Upon the first floor is the chapel and the rooms occupied by students of analytical chemistry; and in the basement is a general repair shop, a furnace-room, &c.

The botanic museum contains the president's office and lecture-room, and the Knowlton herbarium, which is an admirably mounted collection of more than 15,000 species of plants from all parts of the world. Here are also a unique collection of fifty sections of the trunks of trees from the Himalaya Mountains, numerous specimens of native woods and seeds, and about one hundred and fifty models of fruits. The Hills fund of $10,000 supplies the means for the continual increase of these collections, so that this department is well established and endowed.

The Durfee plant house is a beautiful structure, with curvilinear root and conveniences for the propagation and successful cultivation of all kinds of plants. It is filled with specimens of those species which are most interesting from their economic value, their beauty of flower or foliage, or their peculiarities in a scientific point of view. When completed according to the original design it will cover 10,000 feet of surface.

The model barn is one hundred by fifty feet, with an L seventy-five by twenty-five feet, and will accommodate fifty neat cattle and fifty sheep, and contain more than a hundred tons of hay. The posts are twenty-four feet high, and the lower floor is devoted to stalls for cattle and a root room. The upper floor is eight feet above the lower and is easily reached by a drive-way rising about one foot in ten. Near the entrance is a platform scale, and also a trap door, through which roots are dumped into the root room below. In the center of the upper story is a floor extending across the barn with a well-lighted room on either side of the main floor, eighteen by fourteen, and sixteen feet high. One of these is designed for a horse-power to cut fodder, and the other for grain bins and stairs to the story below. Under the entire barn is a cellar eleven feet in the clear, for manure. The barn stands east and west, and teams drive in at one end of the upper story and out at the other. The lower or cattle story is well lighted and ventilated, and opens on the south into a spacious yard, protected from the west winds by the L which contains the sheep pens. The yard is abundantly supplied with soft, running water.

The old barns upon the farm have been moved to convenient locations and thoroughly repaired, and will hold about one hundred and fifty tons of hay.

COURSE OF STUDY AND INSTRUCTION.

There are two classes of students which the college is designed to benefit, viz: Those who wish to obtain a thorough literary, scientific, and business education, qualifying them to act well their part, not only as farmers and gardeners, but also as citizens and men: and those whose circumstances or wishes induce them to seek a more limited and practical course of instruction, with particular reference to farming as a profession. For the accommodation of the latter it is proposed to have a special class every winter, which shall be under the immediate charge of the professor of agriculture, and also courses of lectures upon various branches of science, and special departments of agriculture and horticulture, in common with the students of the regular classes.

The full course of study occupies four years, and those who complete it receive the degree of Bachelor of Science. Three recitations, or their equivalent in lectures or literary exercises, are assigned for each day, except Saturday and Sunday. Saturday is devoted to scientific excursions and recreation. On Sunday all are required to attend church or Bible class; but in all biblical instruction the inculcation of denominational views is, as far as practicable, to be avoided.

All students are expected to engage in manual labor six hours per week when required, without compensation, for the purpose of learning the various operations of the farm and garden; and those who wish to perform additional work for wages will be allowed to do so, and receive at the rate of from ten to fifteen cents per hour.

Students wishing to be absent from any assigned duty are expected to ask permission beforehand, whenever that is practicable, and in all cases to present their excuses after an absence to any officer from whose exercises they may have been absent. A careful record is kept of the attendance, attainments, and deportment of every student, and sent to his parent or guardian at the close of each term, and only such as are faithful, successful, and gentlemanly are allowed to continue as members of the college.

Those who pursue a select course attend recitations and lectures with the regular classes; but persons properly qualified, and desiring special instruction in chemistry, civil engineering, agriculture, or horticulture, may make private arrangements with the officers having charge of those departments. Candidates for admission to the freshman class are examined in writing upon the following subjects: English grammar, geography, arithmetic, and history of the United States. Candidates for higher standing are examined as above, and also in the studies gone over by the class to which they may desire admission.

No one can be admitted to the college until he is fifteen years of age, and every student is required to furnish a certificate of good character from his last pastor or teacher, and to give a satisfactory bond for the prompt payment of term bills. Tuition and room rent must be paid in advance at the beginning of each term; and bills for board, fuel, and washing at the end of every term. The regular examination for admission is held at 9 o'clock a. m. on the second Thursday of September; but candidates may be examined and admitted at any other time in the year. The first term of the academic year begins on the second Thursday of September, and continues thirteen weeks. The second term begins on the fourth Thursday of January, and continues thirteen weeks. The third term begins on the first Thursday of May, and continues thirteen weeks.

There are no free scholarships, and students from other States have the same privileges as those from Massachusetts. The expenses are as follows: Tuition, \$12 per term; room rent, \$5 per term; incidental expenses, \$1 per term; boarding, \$3 50 per week; washing, fifty cents per. dozen; expenses of chemical laboratory to students of practical chemistry, \$5 per term; public and private damages, including chemical apparatus, at cost. Total expenses, including fuel and books, about \$250 per annum.

Most of the agricultural societies of the State pay the term bills of one or more students selected from the applicants within their respective limits. The arrangement of studies in the regular course is as follows, viz:

Freshman year.—First term: Algebra, human anatomy and physiology, chemical physics. Second term: Geometry, French, chemistry. Third term: Geometry, French, botany, lectures upon hygiene, chemis-

try, botany, and agriculture; and exercises in orthography, elocution, and English composition during the year.

Sophomore year.—First term: German, agriculture, commercial arithmetic, and book-keeping. Second term: German, trigonometry, analytical chemistry, with laboratory practice. Third term: Mensuration, surveying, analytical chemistry, zoology, drawing. Lectures upon comparative anatomy, diseases of domestic animals, organic chemistry, dairy farming, and market gardening; and exercises in English composition and declamation, during the year.

Junior year.—First term: Physics, French or German, agricultural chemistry, with practice in the laboratory and the field, drawing. Second term: Physics, rhetoric, horticulture, drawing. Third term: Astronomy, systematic botany, French or German. Lectures upon physics, mineralogy, the cultivation of the vine, of fruit and forest trees, and upon useful and injurious insects, and exercises in English composition and debate, during the year.

Senior year.—First term: Intellectual philosophy, history, physical geography. Second term: Moral philosophy, political geography, the civil polity of Massachusetts and the United States. Third term: Geology, engineering, political economy. Lectures upon stock farming, architecture, landscape gardening, rural law, geology, and English literature, and exercises in original declamation and debate, during the year.

Exercises in gymnastics, military tactics, and the various operations of the farm and garden, through the course.

The college was opened for students October 2, 1867, and has been nearly full ever since. The average age of its members is about eighteen years, and the majority are farmers. Nearly all who have entered have been desirous of remaining through the entire course, and all have performed their various duties with cheerful readiness. The manual labor has been so far performed without any manifestations of dissatisfaction, and has been regarded as an important part of the education.

The faculty consists of a president, who is also professor of botany and horticulture; a professor of agriculture; a professor of military science; a professor of mathematics and physics; a professor of chemistry; a professor of modern languages; and such instructors and lecturers as are required to teach in the best manner the various subjects of the regular course.

The college is generally conceded to have been thus far remarkably successful, and it is confidently expected that the legislature of the State and the wealthy friends of progressive agriculture will furnish funds sufficient to place it in the foremost rank of the educational institutions of Massachusetts.

RECENT AGRICULTURAL BOOKS.

THE ELEMENTS OF AGRICULTURE: A Book for Young Farmers. By Geo. E. Waring, jr. 12mo. 254 pages. New York: The Tribune Association.

This book teaches young farmers the first principles of their profession, and shows them in plain language what science has discovered and told in its necessarily technical terms, and what experience has proved to be of practical value. The facts promulgated lie at the groundwork of farming, and are essential to the business education of every farmer. Its teachings are based on the positive facts of chemistry and the most enlightened practice of modern agriculture. The constitution of plants, the formation and character of soils, the character and varieties of manures, the mechanical character of soils, with reference to draining, sub-soil plowing, rolling, mulching, &c., are discussed with comparative freedom from technical terms.

A scientific description of chemical and mechanical manures is followed by suggestions on their relative value, their manufacture, preservation and application; on the means of restoring deficiencies of soils; on absorbents, various organic and mineral manures, atmospheric fertilizers, leaching, &c. It is mentioned as a "singular fact concerning leaching, that water is able to carry no part of the organic constituents of vegetables to any considerable distance below the surface in a fertile soil. They would probably be carried to an unlimited depth in pure sand, as it contains nothing which is capable of arresting them; but in most soils the clay and carbon retain all of the ammonia and nearly all of the matters which go to form the ashes of plants, very near the surface of the soil. If such were not the case, the fertility of the earth must soon be destroyed, as all of those elements which the soil must supply to growing plants would be carried down out of the reach of roots, and leave the world a barren waste, its surface having lost its elements of fertility, while the downward filtration would render the water of wells and springs unfit for use. Now, however, they are all retained near the surface of the soil, and the water issues from springs comparatively pure."

On the question of spreading manure on land for any length of time before being plowed under, Mr. Waring says: "Practice has gained a triumph over the old theory. There is no doubt that manure so spread is subject to some waste; but what is not wasted is so much better incorporated with the soil by the water of rains, which distributes its soluble parts evenly among all of its particles, that the effect produced is better than if the raw manure had been immediately plowed under, necessarily somewhat irregularly and in spots. In this latter case there would be no loss of material; but some parts of the soil would receive more than was necessary, while others would be deprived of any material benefit, and the land would be less fertile than if every root were sure to find, in every part of the soil, its due proportion of the food. Ammonia is formed only during decomposition; and especially during cold weather there is very little decomposition going on in manure which is thinly spread upon the surface of the land; hence the loss from this cause is not great.

"In the case of very heavy manuring, especially with undecomposed

manure on clay land, a great benefit arises from the fermentation of the dung in the soil, a chemical action producing a mechanical effect.

"Night soil, or human excrement, is the best manure within reach of the farmer. The food of man is usually much richer than that of any other animal, is of a more varied character, and richer in nitrogen, the phosphates, and other inorganic constituents; consequently his manure is made valuable by containing large quantities of these matters. It has been used for ages in China and Japan, and is undoubtedly the secret of their success in supporting an immense population through almost countless ages, without impoverishing the soil.

"Some have supposed that manuring with night soil would give disagreeable properties to plants; this is not the case; their quality is invariably improved. The color and odor of the rose are made richer and more delicate by the use of the most offensive night soil as manure.

"It is evident that this is the case from the fact that plants have it for their direct object to make over and put together the refuse organic matter, and the gases and the minerals found in nature, for the use of animals. If there were no natural means of rendering the excrement of animals available to plants, the earth must soon be shorn of its fertility, as the elements of growth, when once consumed, would be essentially destroyed, and no soil could survive the exhaustion. There is no reason why the manure of man should be rejected by vegetation more than that of any other animal, and indeed it is not; ample experience has proved that there is no better manure in existence. Night soil may be so kept that there will be no loss of its valuable gases, and no offensive odor arise from it, when it can be removed and applied to crops without unpleasantness; and that is, by simply mixing with it a little charcoal dust, prepared muck, dry earth, or any other good absorbent, thus making what is called poudrette."—(See article on earth closets, &c.)

In illustrating the benefits of sub-soil plowing, the author remarks: "If plants will grow better on a soil six inches deep than on one of three inches, there is no reason why they should not be benefited in proportion by disturbing the soil to the whole depth to which roots will travel, even to a depth of two feet. The minute rootlets of corn and most other plants will, if allowed by cultivation, occupy the soil to a greater depth than this, having a fiber in nearly every cubic inch of the soil for the whole distance. There are very few cultivated plants whose roots would not travel to a depth of thirty inches or more. Even the onion sends its roots to the depth of eighteen inches when the soil is well cultivated.

"The object of loosening the soil is to admit roots to a sufficient depth to hold the plant in its position; to obtain the nutriment necessary to its growth; to receive moisture from the lower portion of the soil; and, if it be a bulb, tuber, or tap, to assume the form requisite for its largest development. It must be evident, also, that roots penetrating the soil to a depth of two feet, anchor the plant with greater stability than those which are spread more thinly near the surface."

The chapters on under-draining, plowing, mulching, and weeding, are valuable, but in a compact style scarcely admitting abridgment.

HOW CROPS GROW: A Treatise on the Chemical Composition, Structure, and Life of the Plant, for all students of Agriculture, with numerous Illustrations and Tables of Analyses. By Samuel W. Johnson, A. M., professor of analytical and agricultural chemistry in the Sheffield Scientific School of Yale College, &c. 12mo. 394 pages. New York: Orange Judd & Co. 1868.

Professor Johnson has delivered an annual course of lectures to the scientific school of Yale College for several years, and this work is the

result of studies undertaken in preparing these lectures. It considers plants from three distinct, yet closely related, stand-points, viz: their chemical composition, their structure, and the offices of their organs, and the conditions of their life and growth—the author keeping his eye steadily fixed upon the practical aspects of the subject. "It must not be forgotten," he says, "that a valuable principle is often arrived at from the study of facts, which, considered singly, have no visible connection with a practical result. Statements are made which may appear far more curious than useful, and that have at present a simply speculative interest, no mode being apparent by which the farmer can increase his crops or diminish his labors by help of his acquaintance with them. Such facts are not, however, for this reason to be ignored. It is just such curious and seemingly useless facts that are often the seeds of vast advances in industry and the arts."

In the introduction, the objections sometimes made to theoretical agriculture are met: "In all cases, thought goes before work, and the intelligent workman always has a theory upon which his practice is planned. No farm was ever conducted without physiology, chemistry, and physics, any more than an aqueduct or a railway was built without mathematics and mechanics. Every successful farmer is, to some extent, a scientific man. Let him throw away the knowledge of facts and the knowledge of principles which constitute his science, and he has lost the elements of success. Other qualifications being equal, the more advanced and complete the theory of which the farmer is the master, the more successful must be his farming. The more he knows, the more he can do. The more deeply, comprehensively, and clearly he can think, the more economically and advantageously can he work.

"There is no opposition or conflict between science and art, between theory and practice. If they appear to jar, it is because we have something false or incomplete in what we call our science or our art; or else we do not perceive correctly, but are misled by the narrowness and aberrations of our vision. It is often said of a machine, that it was good in theory but failed in practice. This is as untrue as untrue can be. If a machine has failed in practice it is because it was imperfect in theory. It should be said of such a failure, 'the machine was good, judged by the best theory known to its inventor, but its incapacity to work demonstrates that the theory had a flaw.'

"The progress of agriculture is the joint work of theory and practice. In many departments great advances have been made during the last hundred years; especially is this true in all that relates to implements and machines, and to the improvement of domestic animals. It is, however, in just these departments that an improved theory has had sway. More recent is the development of agriculture in its chemical and physiological aspects. In these directions, the present century, or, we might almost say, the last thirty years, has seen more accomplished than all previous time. * * * * It is, in fact, during the last thirty years that agricultural chemistry has come to rest on sure foundations. Our knowledge of the structure and physiology of plants is of like recent development. What immense practical benefit the farmer has gathered from this advance of science! The dense population of Great Britain, Belgium, Holland, and Saxony can attest the fact. Chemistry has ascertained what vegetation absolutely demands for its growth, and points out a multitude of sources whence the requisite materials for crops can be derived. To be sure, Cato and Columella knew that ashes, bones, bird-dung, and green manuring, as well as drainage and aëration of the soil, were good for the crops; but that carbonic acid, potash, phosphate

of lime, and compounds of nitrogen are the chief pabulum of vegetation, they did not know. They did not know that the atmosphere dissolves the rocks and converts inert stone into nutritive soil. These grand principles, understood in many of their details, are an inestimable boon to agriculture, and intelligent farmers have not been slow to apply them in practice. The vast trade in phosphatic and in Peruvian guano, and in nitrate of soda; the great manufactures of oil of vitriol, of super phosphate of lime, of fish fertilizers; and the mining of fossil bones and of potash salts, are largely or entirely industries based upon and controlled by chemistry in the service of agriculture."

In the chapter on the vegetative organs of plants, it is remarked that the most satisfactory observations we possess on the quantity and length of roots of several important crops growing in the field, have been made by Schubart, who separated them from the soil by the following expedient: "An excavation was made in a field to the depth of six feet, and a stream of water directed against the vertical wall of soil until it was washed away, so that the roots of the plants growing in it were laid bare. The roots thus exposed in a field of rye, in one of beans, and in a bed of garden peas, presented the appearance of a mat or felt of white fibers to a depth of about four feet from the surface. The roots of winter wheat he observed as deep as seven feet, in a light subsoil, forty-seven days after sowing. The depth of the roots of winter wheat, winter rye, and winter colza, as well as of clover, was from three to four feet. The roots of clover one year old were three and a half feet long; those of two-year-old clover but four inches longer.

"Some plants have roots equally able to exist and perform their functions, whether in the soil or submerged in water. Many forms of vegetation found in our swamps and marshes are of this kind. Of agricultural plants, rice is an example in point. Rice will grow in a soil of ordinary character, in respect of moisture, as the upland cotton soils, or even the pine barrens of the Carolinas. It flourishes admirably in the tide swamps of the coast, where the land is laid under water for weeks at a time during its growth, and it succeeds equally well in fields which are flowed from the time of planting to that of harvesting." * * *

"The idea of *species* as distinct from *variety*, which has been held by most scientific authorities hitherto, is based primarily on the faculty of continued reproduction. The horse is a species comprising many varieties. Any two of these animals, by sexual union, may propagate the species. The same is true of the ass. The horse and the ass, by sexual union, produce a hybrid—the mule—but the sexual union of mules is without result. They cannot continue the mule as a distinct kind of animal—as a species. Among animals a species therefore comprises all those individuals which are related by common origin or fraternity, and which are capable of sexual fertility. This conception involves original and permanent differences between different species. Species, therefore, cannot change any of their essential characters, those characters which are hence termed *specific*.

"Individuals of the same species differ. In fact, no two individuals are quite alike. Circumstances of temperature, food, and habits of life increase these differences, and *varieties* originate when such differences assume a *comparative permanence* and fixity. But as external conditions cause variation away from any particular representative of a species, so they may cause variation back again to the original; and although variation may take a seemingly wide range, its bounds are fixed and do not touch specific characters.

"The causes that produce varieties are numerous, but in many cases

their nature and their mode of action are difficult or impossible to understand. The influence of society or abundance of nutriment we can easily comprehend may dwarf a plant or lead to the production of a giant individual; but how, in some cases, the peculiarities thus impressed upon individuals acquire permanence and are transmitted to subsequent generations, while in others they disappear, is beyond explanation."

These extracts give an idea of the nature of the work. The appendix contains twelve tables exhibiting the composition of a large number of agricultural plants and products, viewed from many different standpoints, of value to farmers and students, and which probably cannot be found elsewhere in our language. They are the average of several trustworthy analyses by Professor Wolff, of the Royal Academy of Agriculture at Hohenheim, Würtemberg.

FARM TALK: A series of articles in the colloquial style, illustrating various common farm topics. By George E. Brackett, Belfast, Maine. 130 pages. Boston: Lee & Shepard, 1868.

A volume of familiar conversations of the author, with his neighboring farmers, on haying, butter-making, management of cattle shows, agricultural colleges, apple trees and insects, guess-work in farming, selection of seed corn, farmers' papers, road-making, fancy farmers, farm fences, pigs and poultry, hucksters or middle-men, parasitic plants, winter management of live stock in barns, and other topics interesting to farmers. The colloquies are full of good sense and practical information; a part of one with his neighbor Smith, on "farming by guess," is here given:

"We farmers are a stubborn class to learn. We do not accept facts without a good deal of proof and persuasion, and, in too many cases, work out our own injury through a fear of being too easily deceived. This is a progressive age, and those who allow themselves to fall in the rear in the march of improvement must be content to occupy second-rate positions, and be satisfied with small pecuniary rewards.

"It is somewhat surprising that, notwithstanding the improvements in nearly every department of farming, so little has been effected toward inducing farmers to perform their operations in a more systematic manner, and keep a regular record and account of their farming and business, generally and specifically. But for one farmer who practices such a method, ninety-nine keep all their accounts 'in their heads,' as it is termed, and consequently are properly called *guess farmers*, for they never *know* anything, only *guess* it is so and so. They don't know whether this, that, or the other crop pays best; whether they can afford to sell their stock or produce at such and such price or not. They can't tell whether it is for their interest to continue a certain course of husbandry, use such a fertilizer, cultivate a soil in such a manner, nor even, at the end of the year, are they sure whether their names should be recorded on the profit or loss side of the ledger. Having kept no account of their doings, they are almost wholly in the dark. They can only '*guess* it's about so.'

* * * * * * * *

"Now, see here, Smith. Here is my corn-field record. I have written down everything connected with it, and to-day I have summed it all up, and *know* all about it; there's not a particle of guess-work. Here is the size of the field, kind of soil, when and how many times it was plowed, harrowed, and furrowed; also the amount and kind of manure; how it was applied, and what and how much top-dressing I used. Then there is the time of planting; preparation and kind of seed; how far apart it was planted in the rows and hills, and how many stalks in the hill; when

and how long after planting it came up; manner of cultivating, time of harvesting, &c. And here I have got, in exact figures, the cost, value, and price of everything; planting, hoeing, and harvesting; the value of the corn, beans, pumpkins, and fodder; the value of the manure, rent of land, manure left in the soil, and every item set down in full, so that I know exactly what it cost me to raise that piece of corn, and thus, whether it pays to continue to grow corn under such circumstances.

"This is only an example. All other farm operations may be recorded in somewhat the same manner, more simple if you please, and then there would be an end of the continual *guessing* and *thinking*, and ignorance in regard to those things we should *know* about. Of course keeping such records occupies some time, but how can it be spent to more advantage than in thus obtaining a better knowledge of our profession, and the workings of that special branch in which we may be engaged? Brother farmers, think of this matter, and act upon it. Don't be careless and stubborn, and persistently continue to drive on in the old ruts, simply because you have been accustomed to so doing, or because your fathers have done so before you; but accept a change whenever it is for your advantage to do so; if not for your own sakes, for the good of your boys and posterity."

THE FARMERS' AND MECHANICS' MANUAL, with many valuable tables for machinists, manufacturers, merchants, builders, engineers, masons, painters, plumbers, gardeners, accountants, &c. By William S. Courtney. Revised and enlarged by George E. Waring, jr. 8vo. 506 pages. New York: E. B. Treat & Co., 1868.

This work was compiled by the late William Courtney, of England, and contains many useful tables and facts in the fields of agriculture, hydraulics, mechanics, and most of the ordinary pursuits of life. It comprises the substance of the principal practical "hand-books" of the day, on the measurement of land, hay, grain, timber, weight of cattle, capacity of wagon beds, gauging of casks, valuable facts on plants, soils, manures, the seasons, fuel, weather, fences, draining, soiling cattle, steaming food for stock, dairying, gardening, &c. The work has been carefully revised and enlarged, with a comprehensive abstract of Mr. Waring's treatise on earth closets, which he considers "*the* coming reform that promises more for civilization and for national prosperity than any improvement that has been brought to the notice of the public." An elaborate chapter on tile draining has also been added, and the numerous tables of the original work reduced to the coins and measures of the United States. The book is illustrated in a clear and attractive style.

THE AMERICAN WHEAT CULTURIST. Illustrated with numerous engravings. By S. E. Todd, horticultural editor of the New York Times, and author of the Young Farmer's Manual, &c. 432 pages. New York: Taintor Brothers & Co., 1868.

This treatise on the subject of wheat is given as the result of more than forty years' experience in its culture. The author claims to have investigated the failures of the wheat crop, and has endeavored to discover efficient and practical remedies, discarding all mere theories, and telling farmers how to raise good wheat where their predecessors failed to get fair crops. The work discusses the botanical character and chemical structure of the wheat plant; describes the several varieties; its proper soil, preparation, culture, and fructification; harvesting, general management, and requisite machinery; mildew and other diseases; insect enemies, and remedies for their ravages; closing with a description of the various reapers and other labor-saving machines now in use. The author doubts the practicability of selecting wheat from

different latitudes, so as to secure a variety that will ripen before the midge begins its ravages, but concludes that wheat is not different from Indian corn in its climatology, and that it is governed by the same laws that control other useful plants. The seasons are so different that the same variety, cultivated by the same farmer, and where soil and location are as nearly alike as it is practicable to have them, will not ripen at the same period in two, three, or four succeeding harvests. Consequently, when seed is brought from the north, and it fails to produce a satisfactory crop, or to ripen as soon as the same variety has been accustomed to mature, nothing definite is proved in regard to the climatology of the wheat plant, because the field where it was grown may have been a warm and quick soil, with a southern exposure; and the crop may have had the advantages of superior cultivation and a propitious season, and every circumstance favoring a bountiful crop. On the other hand adverse conditions would produce a very different result, and such experiments lead to incorrect conclusions.

The opinion is expressed that wheat may be raised all over New England, and that the whole matter may be summed up in a few words, viz: cultivate well and manure bountifully. Usually, the best preparation of the soil for wheat is a dressing of rich, well-rotted, or composted barn-yard manure. Unrotted manure tends to produce a heavy growth of straw, liable to rust, and to yield less grain. It is best to apply it late in autumn, harrowing it in after the land has been well plowed. It will be well decomposed by spring. If necessary to apply the manure in the spring, scrape the hog-yard for it with broad hoes, and use heaps of fine manure previously collected; and if the soil be compact and heavy, add well-rotted chip manure. On soils with a great amount of vegetable matter, never apply barn-yard manure unless thoroughly composted or rotted. Where there is a great growth of straw, wood-ashes, either leached or unleached, liberally applied, will have a good influence in producing bountiful crops of grain. After a few years of thorough cultivation and manuring, heavy crops of wheat will appear.

Charcoal dust as a fertilizer is recommended, being composed almost entirely of pure carbon; and when small fragments are exposed to the influence of the weather, they undergo but little change in a long term of years. Still the roots of growing plants will lay hold of the small bits of charcoal, and appropriate the substance in the coal to the growth and development of the stems, leaves, and seeds of grain, fruit, and vegetables. Charcoal, and particularly charcoal dust, has the power of attracting and fixing large quantities of ammonia, and retaining this fertilizing material when buried in the soil, until the fine fibers of the roots require it for promoting their growth. It has the power also of attracting and retaining other gaseous substances besides ammonia, highly beneficial to grass, vines, trees, and shrubs. Observing farmers must have noticed the luxuriant growth of cereal grain about the places where charcoal has been burned, even thirty or forty years ago. The stems of wheat on such old charcoal beds are seldom affected with rust, and the straw is stiffer than that grown where there is no dressing of charcoal. But the particles of charcoal should be ground fine, and reduced to a liquid condition. Charcoal dust scattered in the stables of domestic animals will absorb large quantities of the choicest fertilizing material, imparting a rich pabulum to the roots of growing plants. In the selection of seed, farmers are too careless. Early maturity in wheat is of the first importance. Seed that ripens early should be selected; and that which grows on high, dry, and heavy soil, rather than that from a light, mucky soil, as being whiter and plumper. In this respect

all small grain may be classed together, as barley, rye, and oats. The frequent failure of wheat in northern Illinois is probably due to carelessness in selecting seed; the farmer going to his bin, and cleaning over the required number of bushels to be sown, and really often without its being cleaned at all, from "want of time." If it is a law of nature that like produces like, what can be expected from such a course but a constant, certain deterioration?

COTTON CULTURE. By Joseph B. Lyman. With an additional chapter on cotton seed, and its uses, by J. R. Sypher. 190 pages. New York: Orange Judd & Co. 1868.

Though cotton, the great American staple of export, has been proclaimed a king in the commercial world, no leading crop of the country has been so little studied by scientific men, and none has been cultivated with so little regard to fundamental principles of agricultural chemistry. Mr. Lyman ascribes this to three reasons: 1. The class of labor hitherto applied to cotton-raising has been, in the last degree, rude and unskilled; 2. The opening of vast regions in the south-western States of virgin and inexhaustible soil, obtained at almost nominal prices, has rendered unnecessary that system of culture required in the older States to keep the land in undiminished production; and, 3. Cotton is not a rapid exhauster of any soil.

In this treatise the climate and soil best adapted to cotton growing are described, with practical directions as to the established routine in its culture; its enemies and diseases; how the crop is cultivated; the requisite stock, implements, and laborers; picking, ginning, baling, and marketing; a calendar for all the operations of cotton planting through the year; quality, extent, and characteristics of the cotton lands of North America; the various kinds cultivated in the United States; suggestions in regard to an improved and scientific mode of culture; and how to realize the most from a crop, by combining the growing of cotton with its manufacture into yarns and fabrics; its value as a plant, and the uses to which it may be applied; its past and future history and statistics; and practical suggestions to the various classes of persons who propose to engage in cotton growing. At the close of the work, a chapter is added by J. R. Sypher, formerly an engineer in the United States navy, on cotton seed oil and cake; the manufacture of this oil and its uses in the arts; and the value of cotton-seed cake in stock feeding, and as a fertilizer.

The insects that afflict and sometimes wholly destroy the cotton plant, viz., the cotton louse, the ant worm, the cotton worm or moth, the army worm, and the boll worm, are described and illustrated by drawings made from the engravings of Professor Glover, of this Department. Several suggestions are made as to the best modes of destroying these formidable pests.

The author holds that the preservation and restoration of cotton lands depend on two practices, the one mechanical, the other chemical; the former involving no other expense than a little well-directed labor; the latter, the restoration of a few pounds of potash, lime, and phosphorus to each acre from which a crop has been taken.

1. Mechanical: circle plowing and ditching, to prevent the deterioration of the light, porous, upland cotton soils by washing. It is said that Mr. Jefferson first suggested this, taking the hint from noticing that the peasants in France conformed the curve of their furrows to the slope of the hills on which they were plowing. He recommended the plan to a Mr. Dunbar, who had extensive plantations on the steep but fertile hills near Natchez. The simple good sense of this innovation on the old and ruinous mode of plowing, at once recommended itself, and

it was adopted by the most intelligent planters. But millions of acres had been well nigh ruined and thrown out to sedge grass and the foxes before the improved mode was brought into practice. In that part of Mississippi where it was first adopted, the plowmen have acquired such skill, that, with a good two-horse plow, one will run it in the softest soil, over irregular groups of steep hills, so that hardly a ton of mold will be washed into the bottoms during the most rainy season. This mode of circle plowing is recommended for general adoption on hilly lands. Probably the best way to begin this system is in connection with a series of circle ditches, for the construction of which ample details are given in the volume under consideration.

2. The nature and amount of the requisite fertilizers. After stating what is abstracted from the soil by this crop, a compost heap is recommended, made by hauling muck to the barn-yard, and allowing hogs to root it over; the droppings of barn-yard fowls, being rich in phosphates, should be added, and lime and ashes occasionally sprinkled on the pile; this manure is to be applied in connection with the circular mode of plowing, so as to retain all these fertilizing salts in the soil. The application of about a cord of this compost to the acre would preserve the cotton lands from deterioration and enable them to produce a bale to the acre, for ten, perhaps twenty years.

The following rotation of crops is also recommended: Divide the plowed land into three parts, assigning for each farm laborer five acres in cotton; ten in cereals and potatoes, according to soil and climate; allowing five to remain fallow. Enough stock must be kept to consume all the food grown on the ten acres, which stock should be confined in pens at night, and well littered with leaves and pine straw, (which is short and contains more potash than wheat or oat straw,) and no manure be wasted. A few pounds of sulphuric acid, after it has eaten up all the bones and decayed animal matter on the place, should be sprinkled on this compost. Wood ashes never come amiss. The decayed leaves of the ashes will afford the necessary potash, and the ordure the phosphoric acid and lime. This is to be spread liberally on the land that was fallow the previous year; and by its having been fallow the cocoons of the boll worm will be found to have died out. By this high and careful culture, Doctor Cloud, an intelligent planter in Alabama, thinks he took as much cotton from his five acres as his neighbors from their ten or fifteen acres cultivated in the old style.

However important it may be to the South to combine the growing of cotton with its manufacture into yarns and fabrics, it is not likely to be done, to any great extent for many years, on account of the sparseness of the population. Operatives are wanting, and, not only so, but the class from which operatives are produced.

Mr. Lyman closes his part of the treatise with some practical suggestions as to the various classes of persons who will find it an object to engage in cotton-planting. He gives some interesting statistics and strong commercial reasons for believing in a future for cotton planters more brilliant than anything in the past, when the new system of free labor shall have settled down on a firm basis; the experience of the world, since the outbreak of our late civil war, having established the great superiority of North America as the best cotton-growing region of the globe.

GARDENING FOR PROFIT: A Guide to the successful cultivation of the market and family garden. Illustrated. By Peter Henderson, South Bergen, New Jersey. 12 mo. 245 pages. New York: Orange Judd & Co. [illegible].

The author of this volume is well known as one of the most successful

market gardeners on a large scale in the vicinity of New York; and, having had practical experience in all the departments of his profession, his book has a value which places it above simple compilations on this subject.

Detailed instructions are given as to the proper location and preparation of a garden, the necessary implements, the management of cold-frames, hot-beds, and greenhouses; transplanting, and the packing of vegetables for shipping; and the leading vegetables now used in this country, and the troublesome insects to be encountered, are described. A calendar of operations for each month is given, with advice as to the proper men for the business, the amount of capital requisite, and the working force per acre necessary in cultivating the vegetable gardens that supply the great markets of New York and Philadelphia.

In the chapter on drainage, an instance is given of a "German who leased for ten years eight acres of wet land near New York. After working it for three years, with late and stinted crops that barely afforded him a living, he was advised to drain it, but hesitated, as his lease had but seven years to run. He finally acted on the advice, and spent $500 in tile-draining. He then obtained early and luxuriant crops, and at the termination of his lease, purchased and paid for his eight acres $12,000, the savings of six years on his drained garden." Mr. Henderson adds, "I honestly believe that had he gone on without draining, he would not have made $1,200 in twelve years, far less $12,000 in six years." So much for judicious draining.

Among the fertilizers now wasted, the refuse hops of breweries are represented to be of the first importance, as they possess high fertilizing properties, and are excellent for breaking up and pulverizing the soil, and Mr. Henderson considers them of nearly double the value of stable manure. The shavings and scrapings of horn and whalebone are also rated as valuable, composted with hot manure, which extracts the oil from the shavings, intermingling it with the whole. He has known the mixture of five tons of whalebone shavings with ordinary stable manure, to make $400 difference per acre in the value of the crop. Such factories not being common, however, it is only in certain localities that this fertilizer can be had. Sugar-house scum, composed largely of blood, charcoal, and saccharine refuse, is also a valuable fertilizer, properly composted with muck. The common concentrated manures of guano, bone-dust, poudrette, &c., are used with very satisfactory results. Mr. Henderson is convinced by direct experiment that manures, either liquid or solid, organic or inorganic, are unprofitably employed when applied to plants in a dormant state. In the highly cultivated gardens about our large cities, where the grounds are so incessantly plowed, harrowed, and dug over, insects have but little chance for a foothold; tobacco water, applied with a syringe, destroys them in the forcing-houses; and bone-dust sprinkled over late sowings not only kills the cucumber bug, but encourages the growth of the crop. The most formidable insect gardeners have to encounter is the *Anthomyia brassicæ* of Europe, which attacks the roots of the cabbage family, causing the destructive disease known as "club-root." Mr. Henderson discredits the old dogma that it is caused by hog-manure, heavy soil, light soil, &c., and claims that the insect is harmless to the plant when in the perfect state the first season, but that it is attracted by it, deposits its eggs in the soil, and in the maggot condition, in which it appears the second year, it attacks the root, which becomes enlarged and carious, ruining the plant. Cabbages and cauliflowers, of course, can be safely grown only in alternate years on the same soil. On soils containing a large amount of lime, this insect cannot exist to an injurious extent.

The book closes with a useful chapter on the propagation of plants by cuttings, in which the author simplifies what has often been befogged with mystery by gardeners.

This book is handsomely printed and illustrated.

GARDENING FOR THE SOUTH: or, How to grow vegetables and fruits. By the late William N. White, of Athens, Georgia; with additions by Mr. J. Van Buren and Dr. James Camak. 12mo., 444 pages. Illustrated. New York: Orange Judd & Co. 1868.

This is a revised edition of the late William N. White's "Gardening for the South." After his death his corrections for the new edition were revised by Mr. Van Buren and Dr. Camak, who have incorporated the more important discoveries made in horticulture during the last dozen years. Though originally prepared for the climate of the southern States, the seasons of which differ so much from the northern in heat and dryness, its utility is not confined to that section. The characteristics and improvement of soils; the sources and preparation of manures; rotation of crops; hot-beds, cold-frames, and pits; garden implements; the propagation of plants, budding, pruning, grafting, training, mulching, protection from frosts, insects, vermin, &c., are discussed. We quote a few paragraphs from the chapter on rotation of crops:

"The same crops cannot be grown from year to year upon the same soil without decreasing in productiveness. All plants more or less exhaust the soil, but not in the same degree nor in the same manner; hence as different plants appropriate different substances, the rotation of crops has considerable influence in retaining the fertility of the soil. If the same kind of plants is continued upon the same soil, only a portion of the constituents of the manure applied is used; while, by a judicious rotation, everything in the soil or in the manure, suitable for vegetable food, is taken up and appropriated by the crop. However plentiful manure may be, a succession of exhausting crops should not be grown upon the same bed, not only because abundance is no excuse for want of economy, but because manure freshly applied is not so immediately beneficial as those remains of organized matter which, by long continuance in the soil, have become impalpably divided and diffused through its texture, and of which each succeeding crop consumes a portion.

"Some crops are so favorable to weeds that if continued long upon the same bed, the labor of cultivating them is much increased; while if raised but once in a place, and followed by a cleaning crop, the weeds are easily kept under. Besides, many crops planted continually in the same soil are more liable to be attacked by the insects which are the peculiar enemies of those plants.

"Many insects, injurious to plants, deposit their eggs in the soil which produced the plants they have infested, ready to commit their depredations upon the succeeding crop; but if this is changed to a distant locality they often perish for want of their proper food. Many parasites, also, have their seeds or spores in the soil, to the increased injury of the succeeding crop, if of the same species.

"Again, different plants derive their principal nourishment from different depths of soil. The roots of plants exhaust only the portions of soil with which they come in contact. Perpendicular-rooted plants throw out few side-roots, and derive most of their nourishment from a considerable depth, while fibrous-rooted plants seek their food near the surface. Plants of the same species extend their roots in a similar direction, and occupy and exhaust the same strata of earth.

"Different plants, by means of their roots, act differently upon the physical nature of the soil. Surface roots spread abroad their tufted

fibers, which, in their decay, break up and lighten the surface soil, while the roots of clover have a somewhat similar effect upon the deeper strata.

"The most exhausting crops are, in general, those which are allowed to perfect their seeds, as they extract from the soil all the essentials of the plant from the root to the seed. The seeds of many species draw from the soil more largely its ammonia, phosphates, &c., than the total amount extracted in the formation of all other parts of the plant. Root-crops are generally less exhausting, and plants cultivated for their leaves are usually still less so.

"A rotation was formerly thought necessary from an idea that each plant throws off from its roots into the soil certain matters which are injurious to others of the same species, afterward grown upon the same soil. It was also thought that there were some tribes of plants, the fig, for instance, of which the acrid juices from the root injured the soil and the plants grown near them; while of others, as of legumes, the sweet juices were beneficial to the soil and the adjacent or succeeding crops. These views are not now considered tenable."

Following the preceding topics of general application is a description of the vegetables and fruits adapted to the climate of the South.

THE SMALL FRUIT CULTURIST. By Andrew S. Fuller, practical horticulturist, Ridgewood, Bergen County, New Jersey. 276 pages. Illustrated. New York: Orange Judd & Co. 1868.

The progress of small fruit culture in the United States during the last dozen years has been remarkable. The facilities afforded by our numerous railroads, and the liberal provisions of our post office laws, by which plants, cuttings, and seeds can be sent through the mails at a trifling expense, have stimulated horticulturists to great efforts in producing new and improved varieties. In addition to this, the extensive use of fruit-preserving cans creates a demand for thousands of bushels of choice fruits for home use for families in both town and country, and tens of thousands for hotels, saloons, and commercial purposes. Nearly every steamer and sailing vessel leaving our ports takes a supply for use on the voyage, and it often forms a part of their freight. The inducements for cultivating small fruits are thus very large, and, in fact, extensive culture and success in producing new and better varieties of berries have been a prominent feature in American horticulture. New villages are springing up on our railroads which soon become shipping points to the large markets, and many places that did not exist ten years ago, are now annually sending to market half a million to a million baskets of fruits every season. The public appetite for fruits literally grows with what it feeds on.

This extended cultivation of small fruits has created a demand for practical information from both the amateur and professional cultivator, and Mr. Fuller has given in this volume the results of his personal observation and experience, extending over a long period of years. The history, character, culture, and uses of the strawberry, barberry, raspberry, blackberry, dwarf cherry, currant, gooseberry, cornelian cherry, cranberry, huckleberry, and shepherdia, are followed by an account of the insects and diseases by which they are afflicted, and a description of the leading native and also foreign varieties.

This work closes with a chapter of suggestions on gathering and preparing small fruits for market, with a description of the various baskets and boxes used. On the large berry farms in New Jersey the harvest time is a season of as much rejoicing as the time of vintage in the vine countries of Europe. Employment in picking is afforded to quite an army of women and children, and good feeling prevails on all sides.

THE GRAPE CULTURIST. A treatise on the cultivation of the native grape. By Andrew S. Fuller, practical horticulturist. A new and enlarged edition. 286 pages. New York: Orange Judd & Co. 1868.

The grape is one of the most grateful and delicious of all fruits, the most universally cultivated of all fruit-bearing plants, and at an early age yields in profusion greater than any other fruit. Noah "planted vineyards," and the Promised Land was a land of "wheat, barley, and vines." Its growth extends over thirty degrees of latitude—from Persia to France. The fine varieties of the Eastern Continent, however, cannot be raised in this country, except by artificial means; and after two centuries of unsuccessful attempts to grow them, pomologists have turned their attention to the improvement of our native species, and many choice and beautiful varieties have been produced. Since the out-door culture of European varieties has been discarded for our neglected native sorts, vine culture has become established as a branch of American industry.

Mr. Fuller has given a practical treatise on the culture of the native grape, comprising the propagation of new varieties from seeds, their increase by budding, their management in propagating houses, and by cuttings in the open air; layering, grafting, hybridizing, crossing, and transplanting the vines; soil and situation; trellises; the proper time for pruning, and the best method of pruning and training; culture in gardens of limited space; suggestions on gathering and preserving the fruit; the insects and diseases to which the grape is liable; description of the best varieties; closing with a review of the various systems of training. The work is written in a clear and intelligible style, and is well illustrated.

For a vineyard in the northern States, Mr. Fuller concurs with most writers in recommending a full southern exposure, and if the land descends to the south, so much the better. About Cincinnati the side hills are generally selected by the Germans; but though a side hill may be a desirable location, other situations nearly or perfectly level are considered equally good. The exposure should be southeast, east, or southwest, but never north or west. Virgil said, "Nor let thy vineyard bend toward the sun when setting;" which advice is as applicable now as it was two thousand years ago. In selecting a location, the surroundings must be taken into account; if the land has no protection from the north and the northwest, a belt of evergreens would prove a great protection; it should be elevated thirty to forty feet above streams or small ponds of water, to obviate the effects of early and of late frosts. Large bodies of water, however, are not considered injurious, as they absorb heat in large quantities in summer, and give it off slowly in the fall, affecting the surrounding country materially, by preventing early frosts. In spring, the water being cold, the atmosphere is kept cool for quite a distance from the shore, and vegetation thus prevented from starting too early. Where the soil is sandy or gravelly, it should be enriched by some organic materials, as barn-yard manure, muck, or leaf mold. Thousands of acres of such lands in the eastern States, now considered almost worthless, if enriched with the cheap materials found in their vicinity, would make the best vineyards in the country. On such soils, though the growth is not luxuriant, the fruit is of the richest quality, and the land is easily worked, and does not retain an excess of moisture, being thoroughly underdrained by nature. Granitic and limestone soils are strong and excellent, and their proper mechanical condition is easily accomplished by plowing or trenching, this mechanical texture of the soil being as important an element as its ingredients in the success or

failure of its crops. New soils are preferable to those that have been long in cultivation, and such as are loose and friable, whether of loam, sand, gravel, or the calcareous debris of rocky hill sides, are vastly better than clay or muck. Though the latter may be made somewhat available by underdraining and trenching, they will generally prove unsatisfactory in the end.

After a vineyard is planted, sufficient manuring is required to keep up a healthy growth. Too much manure may increase the size of the fruit, but will injure its quality. It should be applied on the surface, and worked in with a cultivator or hoe; but a plow ought never to be admitted into a vineyard. Frequent top dressings are better than large applications at long intervals; and rank, unfermented manures should never be used, as they affect the flavor of the fruit and the health of the leaves. Mulching and frequent stirring the soil with the hoe will be found very beneficial.

Instead of the very common mode of making grape trellises, with wires running horizontally, which is expensive and troublesome, as the wires expand and contract with every change of temperature, Mr. Fuller recommends a trellis with horizontal bars and perpendicular wires, built in the following manner: Select posts of durable wood, four to six inches in diameter, and six and a half feet long; set them in the ground two and a half feet deep, in a line with the vines, and eight feet apart, that is, if the vines are at that distance; a post should be placed between each two vines, at equal distance from each. When the posts are set, nail on strips, say three inches wide and one inch thick, the lower strip being placed one foot from the ground, the other near the top of the posts; then take No. 16 galvanized wire, and put it on perpendicularly, say eight to twelve inches apart, or just where the upright-bearing shoots are to grow, twisting it around the upper and the lower bar. On this kind of trellis the arms of the vine should be fastened to the lower strip, right and left, either with strips of leather tacked on, or tarred rope tied loosely around the arm. As the young shoots start, they can be loosely tied to the wires at any time when necessary.

Mr. Fuller recommends pruning the vines in autumn, as soon as the leaves have fallen, particularly if the wood is to be used for propagation. The vines should not be cut quite back to the buds that are wanted for fruit, as the uppermost buds left for that purpose are apt to be winter-killed, the sap receding from the part which has been cut, leaving the end dry, and the buds exposed to the severity of winter. Early in the spring, before the sap begins to flow rapidly, the vines must be gone over a second time, and these extra buds and dried ends cut off. Where vines are laid down in winter, the pruning can be completed at once; no second pruning is necessary, the covering of the vines affording a protection from the effects of both cold and dryness.

In regard to pruning and training, it is not considered judicious to dwarf our native vines to that extreme to which it is carried in some parts of Europe, but we should stop midway between it and the wild vines of our forests. Some refer to the strolling habit of the latter as an example for training the cultivated ones; but it is not the wild vine that is under consideration, but improved varieties, which have parted with much of their wild character. The vine is one of the most tractable of all fruit-bearing plants, and the easiest to control, notwithstanding its wild and rambling nature. Its natural growth is upright, in which position the larger portion of the forces of the plant are expended in producing a growth of wood and leaves, while fruit is produced sparingly. This is illustrated in the wild vine, which does not produce fruit abund-

antly till it reaches a position where it can spread out horizontally on high trees or low bushes by the water-side, with its clusters of fruit hanging in the shade underneath.

These facts indicate several fundamental principles: 1. That, while the leaves require a full exposure to the sun, the fruit ripens fully without it. 2. That, while the vine grows upright, it produces its most vigorous growth of wood, but its fruit-producing powers are not fully developed until it takes a horizontal position. 3. That fruit is produced most abundantly upon the uppermost branches, it making no difference whether these upper branches are on the tops of lofty trees or on the humble shrub, showing that height is not necessary, as fruit at fifty feet from the earth is no better than that at five, other circumstances being equal. It only shows that the sap naturally presses to the top, and forces out fruit-bearing branches at that point. 4. The fruit is produced upon the young, growing canes, and opposite to the first few leaves that are formed; usually the first to the third leaf will have a bunch of fruit opposite; fruit is seldom produced beyond the fifth leaf. This rule being applicable to all varieties of species, it is easy to regulate the quantity of fruit at each annual pruning, by leaving a certain number of well-developed buds, estimating each one at so many bunches of fruit.

The foregoing are considered the main principles to be observed in pruning and training. Very intelligible directions and drawings are given by Mr. Fuller to illustrate many minor points, founded on long and careful experiments.

Grapes are frequently gathered long before they are really ripe, either to get them to market early, or because they appear to be ripe, when, in fact, the ripening process has only commenced. Nearly all varieties change their color fifteen to twenty days before they are fully matured; and as grapes must ripen before being gathered, or not at all, too much care cannot be given to this point.

Few of our cultivated fruits are less damaged by insects than the grape. It has formidable enemies, however, which have rapidly increased during the last ten years, owing, chiefly, to the wanton destruction of those birds that live mostly upon them. Mr. Fuller gives a popular description, with drawings, of most of the insects known to be injurious.

Our native grapes are not subject to many diseases, except in particular localities, and these are confined mainly to the fruit. The most destructive is the black rot, the great scourge of the western States. The Catawba vineyards about Cincinnati have been so seriously injured that some cultivators have become discouraged and plowed them up, devoting the land to other purposes. Very poor soils, or overrich ones, or heavy, wet soils, where the roots are immersed in stagnant water, may all assist in developing disease; and vines are often allowed to be so overloaded with fruit, that they cannot remain healthy and vigorous. By many the cause of the rot is ascribed to heavy dews, which several facts and experiments seem to justify. If such is found to be the case, a preventive is readily applied by nailing a wide board flatwise on the top of the trellis. It is well worth a trial.

The work closes with a descriptive catalogue of the principal native grapes cultivated, and a review, with numerous illustrations, of various systems of pruning and training.

VINEYARD CULTURE IMPROVED AND CHEAPENED.—By A. du Breuil, Paris. Translated by E. & C. Parker, of Longworth's Wine House, Cincinnati. With notes and adaptations to American culture, by John A. Warder, author of "American Pomology." Cincinnati: R. Clarke & Co. 1868.

The author of this work is a teacher of vine and tree culture in the

Imperial School of Arts and Trades in France, and has been employed by the government as a lecturer through the provinces of the empire. His book comprises details on the choice of a site for a vineyard, the selection and management of vines, and the diseases and noxious insects to which they are subject, closing with the vintage. Most of the author's remarks on manures, pruning, and cultivation have a general application in the United States, as well as in France. Still the conditions of grape culture in the latter country are so different from those in this, that the chief value of the book arises from the elaborate and practical annotations of Dr. Warder, which comprise about one-third of the volume. These follow every leading suggestion of du Breuil, and adapt his directions to the state of things in this country. The culture of the vine may well receive the fostering care of the French government, in view of its importance, yielding millions to the state, and furnishing employment to eight or ten millions of people. In the south of France, particularly, it is a very certain crop, requiring but little labor relatively to its net profit. It has banished fallows, continuously occupying the whole extent of country that has a suitable climate; and is adapted to all kinds of soils, even those which formerly produced only useless thorns and briers. It furnishes labor at all seasons, to all ages and both sexes, and requires but little manure, allowing the greater portion to be applied to other crops.

In this country, after many failures of the early vine-planters in attempting to acclimatize the foreign varieties of grapes, the business has at last been started in the right direction: rapid strides have been made, and there is no calculating the extent which our vineyards may embrace in a few years. Energy and intelligence, with abundant wealth, are embarked in the business. New varieties are produced by crossing and selecting the species and varieties indigenous to the country, and thus better adapted to our soils and climate; and it would seem that such efforts must be crowned with abundant success.

THE GRAPE VINE: A practically scientific treatise on its management: explained from his own Experiences and Researches, in a thorough and intelligible manner, for Vineyardists and Amateurs in Garden and Vine culture. By Frederick Mohr. Translated from the German, with Hints on the Propagation and General Treatment of American Varieties, by Horticola, (Charles Siedhof.) 12mo., 120 pages. New York: Orange Judd & Co. 1867.

The object of the author of this work is to popularize the results of modern science concerning the cultivation of the grape-vine. He first describes the vine itself, with its adaptations to so many different climates, and the facilities with which it produces, in the hands of man, new varieties, which conform themselves to all circumstances, with their different colors, sizes, and qualities. This is followed by remarks on the development and structure of the vine, the reasons for pruning and the different modes of doing it, training on trellises, the grape disease, and treatment of vines injured by frost. It has been carefully translated by Mr. Siedhof, who has added hints on the propagation and general treatment of American varieties, including the different modes of propagation and hybridization.

Hardly any other plant is so well adapted to variation of management as the grape vine. No system of cultivation is absolutely the best for all regions: the climate and nature of the variety must be considered. All methods are successful to a certain degree: and of all plants, the vine gives the most ample reward for the care bestowed upon it: and many a vacant spot in a garden may be used for planting a choice variety so that it may be turned to account.

The too common practice of inexperienced cultivators, of stripping the leaves from vines near the clusters of fruit, to admit the rays of the sun directly to the berries, is held to be altogether wrong. It is sufficient when the sun shines on the leaves, and the clusters are growing. This is the true and natural condition. No sugar can be formed in the berry, if the leaves are removed, because no oxygen can be eliminated by it; the berry only collects and prepares the sugar from an organic substance formed by the leaf. Besides, the berry is often injured by the direct rays of the sun during the hot days of summer.

"The true poetry of wine, its beautiful fragrance, called the bouquet of the wine, is the exclusive property of the northern regions. The wines of the south, however rich in alcohol and sugar, are entirely destitute of that bouquet: or they have a common odor like Port, Madeira, Xeres, and Malaga, without any peculiarity." The noble qualities of the vine are thus set forth:

"The grape-vine is, among plants, what the horse is among animals, one of the most precious boons nature has given to man. It follows him to climates of a very different character, and admirably rewards him for all the trouble devoted to it. As in the horse, everything in the grape-vine is beautiful and noble. The delicately-shaped leaves, the fragrant blossoms, the delicious grapes, extend their development over the whole year, except during the severe months of winter, and require uninterrupted and careful treatment by the hand of man. The grape-vine grows on the rocky hill and in the fertile garden, trails on the ground and climbs to the roofs of houses. By training, it may be kept as a small shrub, or made to cover a surface of a thousand feet.

"The grape-vine changes its character, and adapts itself in a wonderful manner to every country that affords it the necessary warmth. The difference in the varieties is as great as in the various races of dogs. The berry varies in size from that of a large pea to that of a small plum; its color is green, yellow, flesh-color, red, blue, and black. Sweetness and acidity are mixed in the most varying proportions; its aroma is unsurpassed.

"The grape is decidedly the most noble of fruits; it is sweeter than any other, and the admixture of a little acid renders it exceedingly delicious. The liquid contents of the grape elevate it above the apple. It is the only fruit of our climate which is drank rather than eaten. Finally, the fermented juice of the grape, the wine, prolongs the time of the enjoyment of it for a series of years."

THREE SEASONS IN EUROPEAN VINEYARDS: Treating of Vine Culture; Vine Disease and its Cure; Wine-making, and Wines, red and white; and Wine Drinking as affecting Health and Morals.—By William J. Flagg. 12mo., 332 pages. New York: Harper & Brothers. 1868.

Mr. Flagg has spent three years in the vineyards of Europe, collecting facts in all the branches of vine culture, the manufacture of wines, and the sulphur-cure for the oïdium, the most formidable disease that attacks the vine.

The leading points discussed and conclusions reached are: 1. That long pruning, as practiced in America, is an efficient cause for the decay of our vines. 2. The want of drainage, especially in the Ohio valley, has been equally injurious. 3. The advantage of growing vines on plains, rather than on hills, except where the quality obtained from hill-grown vines is such as will compensate for the larger cost and smaller yield. 4. Training the vines in "low souche," (that is, by stump or stool,) without stakes or trellis, is probably better adapted to our warm summers,

than the expensive methods imitated from countries where peaches can only be ripened on trees flattened and fastened to the south sides of high walls. 5. Red wine is preferable to white as the future beverage of Americans. 6. The sulphur-cure is entirely efficacious against the disease of the vine, in all its many forms, if properly applied.

Mr. Flagg reached Bordeaux in the fall of 1866. This city is the commercial center of several wine districts, where the famous Château-morgaux, La Tour, Lafitte, and Sauterne wines are bought and sold, and shipped to America at such a profit that some of them retail in New York at $6 per dozen, costing in Bordeaux only six francs, say $1 20 in gold. One of the first objects that arrested his attention was the noble draught horses of Normandy, (the Percherons,) that haul between three and four tons on their enormous drays. He thinks if "we could replace our 6,000,000 nags, of one sort and another, with one-third of their number of a breed like this, the 2,000,000 would do all the work, at a great saving" of food and attendance. This breed is now being introduced into this country.

Adulterations of liquors appear to be as common in Europe as in this country, and the author regrets that Americans pay so extravagant prices for "pure French brandy," and must even then be tormented with doubts of the genuineness of the article. On the Gironde he saw vessels of every nationality after cargoes of claret and cognac. One of them bore the flag of our country, and, as he gazed on its folds, he "knew it would soon be waving proudly over a homeward bound cargo of as inferior liquor as Bordeaux could export." As a table fruit, nowhere in France, Switzerland, or Germany, did he find grapes equal to the Catawbas of the Ohio valley when in their prime.

He was struck with the noble breeds of oxen used in the vineyards for hauling loads of fruit to the vats. They were thoroughly trained, and moved along in a dignified manner, "as if they drew their load of their own free will, and not from any fear of the slight rod armed with only half an inch of darning needle, carried rather as a guide than a goad, by a man who walked beside them without blasphemy or loud words of any kind. It means something, that the French use the word "conductor" where we say "driver."

"Every ox wore a net over his face, quite a neat thing too, and a cloth that covered the back and hung down to the knees, which were for protection against insects that swarm from the low lands of the river border. This highly-esteemed race is the result of kind and judicious treatment, as much as of the rich pastures of the Gironde.

"In Ohio I could never get an ox-driver to undertake any heavy work without a fresh sea-grass snapper at the end of his short-handled, rattlesnake-looking whip, nor unless his own lungs were in good order for swearing. In one year I received the resignations of two good drivers, tendered solely because their lungs had given out. Both were good men, and really meant nothing but business when they swore and scourged. What breed of beast such evil influences and rude discipline will produce, the future will reveal."

The consumers of French wines may have their love for the same somewhat abated after learning some of the processes of the manufacture. At Médoc, the grapes are heaped in a conical form on the "pressoir," and five or six men, with pantaloons rolled up to their knees, trot about in a circle over the grapes, to crush them. They say no other mode so effectually crushes the pulp without breaking the seed; in fact, that it is important for the quality of the wine that it be trodden out with the naked feet. And in manufacturing Burgundy wine it is necessary to

stir up the liquid in the vats, so that the skins, seeds, and new-made alcohol may properly combine with their coloring matter. The whole mass has to be stirred up twice from bottom to top during the process of fermentation. It requires four men to do it well, "who strip naked, and then go into the wine-vat, and there, with feet and hands, fingers and toes, turn over, stir about, and mix the liquid." Mr. Flagg feelingly remarks, "there might be a cleaner way of doing the thing; I don't think there could be a fouler. * * * I shall never drink any more Burgundy."

The oïdium is one of the greatest scourges of European vineyards; and the time may come when it will be equally troublesome here. But mildew, rot, and red leaf, in other words, oïdium, can be cured and kept down, as has been proved by Mr. Marés, who has published all necessary details on the subject; Mr. Flagg has translated and incorporated into his book the whole of Mr. M.'s manual, which gives the development and characteristics of the disease, the properties of sulphur, and the modes of applying it to diseased vines, with abundant evidence of its complete efficacy.

The oïdium was first observed in England in 1845; since that time it has spread over all Europe, ravaging the vineyards. It generally attacks old vines, as new ones are strong enough to throw off all ailments for a few years after they come into bearing. It is a microscopic, cryptogamic parasite that feeds on the outer skin of all the green parts of the plant, and on the grapes. The first symptom of the development of the disease is the dull and yellow aspect of the vine; the white spots on the shoots, leaves, and fruit, and musty odor, indicate the presence of the mushroom parasite and its active vegetation; the gray color on the parts attacked shows the old age of the parasite; and the black spots on the shoots, leaves, and grapes are traces of its mischievous labors. The stunting of the shoots and grapes, the curling and premature fall of the leaves, the development of inter-leaves, and cracking and drying of the berries, are consequences of the alterations to which the exterior of their tissue has been subjected by the parasites; they lose their elasticity and are ruptured when the interior parts come to grow. Flour of sulphur is not only a sure remedy for this disease, but has the property of stimulating the growth and fructification of the vine, communicating to it vigor to repel the attacks of the parasite. It must be thoroughly applied with a bellows or dusting-box, so as to reach all the green surfaces of the vine, shoots, leaves, and all the fruit, as soon as the oïdium appears, and renewed as often as it reappears, perhaps four or five times through the season. Ample details are given on all these matters, for which the reader is referred to the book. Mr. Marés has 250 acres in vines, and often makes 375,000 gallons of wine in a season.

A chapter is devoted to the important question, whether the "low souche" or stump system of cultivating vines is practicable in America, and the affirmative is assumed. Dear labor, cheap land, and an immediate need for much cheap wine are strong reasons in favor of it. The cost of creating an acre of vineyard on our old system, with fashionable varieties, wire trellises, and other items, is between $600 and $800, besides the land, and say $150 more per annum for attendance. On the souche method he is of the opinion the cost would not exceed one-third of the preceding. No stakes or trellises are required, neither pinching, rubbing off, willow-tying, straw-tying, nor leaf-pruning; but winter pruning only; and as regards plowing and cultivating, the same labor that good farmers bestow on their corn-fields will suffice.

"An acre of good sandy loam, planted in souche with Concords or

Ives's Seedlings, ought to bring an average annual crop of 1,000 gallons of wine." Full details, with illustrations, are given of the mode of planting in souche, which persons going into vine-culture should consult. Those inclined to "try the experiment should begin with varieties whose joints are short, the canes stiff, or, what is better, erect in their growth, and whose fruit-buds are found close to the old stock or souche."

The plants are set five or six feet apart, and pruned so that at the third year the main stump will be ten or twelve inches high, with five or six branches spreading in all directions without expense of stake or trellis, the fruit also receiving the benefit of whatever heat is radiated from the earth.

THE SCUPPERNONG GRAPE: Its History and Mode of Cultivation, with a short treatise on the manufacture of wine from it. By J. Van Buren, of Clarkesville, Georgia. 16mo., 50 pages. Memphis, 1871.

The necessity of resorting to a more diversified system of industry in the South has awakened attention to some of its hitherto neglected native productions. Among these, the culture of the Scuppernong grape and the manufacture of its wines are attracting so much attention, that Mr. Van Buren has collected all available information on the subject, which is given in this small treatise.

The original type of the Scuppernong grape is a native of the southern States, and is found growing wild from North Carolina to Florida, climbing to the tops of the highest trees. Its appearance, habits, wood, and fruit are quite distinct from all other native varieties, and it is easily known by its small leaves, seldom over two or three inches in diameter, which are smooth and glossy on both their upper and under surfaces. It is too tender for successful cultivation north of the Potomac, as, wherever the mercury falls to zero, it is killed to the ground; but in the southern States it is very hardy, astonishingly productive, and an excellent wine grape. Its bunches are small, loose, and seldom composed of more than half a dozen large berries, three-quarters to one and a quarter inch in diameter, flesh quite pulpy, though when thoroughly ripe and a little wilted, the pulp dissolves into a sweet, rich, aromatic juice, with a musky scent and flavor. The berries then leave the stem so freely, they cannot be picked in clusters. The vine is a vigorous grower, and the most long-lived of the grape-family.

The Scuppernong is propagated by layers only, and will not grow from cuttings, either in the open ground or under glass with bottom heat. The rooted layers are planted in a vineyard, thirty feet apart each way, by the side of posts seven feet high. When the vine reaches the top of a post, four other posts are set of the same height as the one to which the vine is tied, at a distance of ten feet from one another, forming a square to that to which the vine is tied in the center. On the tops of these posts are fastened four rails from one to the other. On these rails are placed sawed strips an inch or two thick, by three wide, and a foot apart, on which the branches of the young vine are trained for a year or two, when it will need no further care. The vine must not be permitted to get into a thick or tangled mass on the arbor, in which case the interior wood dies for want of sun and air. As it grows to the outer edge of the arbor, another row of posts is set ten feet from the others, with rails, thus extending the arbor as required.

It is claimed that the Scuppernong is singularly exempt from disease, mildew, or rot, and from the attacks of insects. Its productiveness is almost incredible. Six-years-old transplanted vines frequently yield three bushels each of clear grapes, after which they continue to double

in quantity for several years. Vines ten years old have been known to yield thirty to fifty bushels per vine. A large vine near Mobile, thought to be one hundred years old, is said to have produced more than two hundred bushels in a season. There are many other apparently well-authenticated cases of extraordinary fruitfulness. Of course, such a grape will produce a larger amount of fruit and wine per acre than any other known variety.

The juice of the Scuppernong has a natural tendency to make an effervescing or foaming wine, and with proper treatment also a rich and delicious still wine. For either kind the grapes must be fully ripe, which is known by their becoming a little wilted and of a yellower color than when eatable. After the grapes are crushed between rollers, the juice is strained as it comes from the press into clear oak barrels, and a pint of brandy (distilled from the juice of the Scuppernong) or a pound and a half of crystallized sugar added to each gallon of juice. The barrels should be filled full, so that all filth may work out at the bung-hole, which must remain open for two weeks. At that period, if sugar is used, the bungs must be put in tight; but if brandy, the barrels should be immediately bunged up when it is added. A good cellar is indispensable, in which to place the barrels of juice, to prevent acetous fermentation from the changes of the atmosphere. In February or March following, the wine is to be racked off into clean casks; and that intended for champagne into extra strong bottles, adding to each a table-spoonful of the best clarified sugar; then cork and place the bottles in a cool cellar, bottom upward, undisturbed till the beginning of July. During this time a second fermentation takes place, depositing a sediment in the necks of the bottles, requiring some care and skill to remove. Each bottle should be carefully taken up, keeping it inverted; untie the fastening to the cork, take it out suddenly, and instantly recork it. This will blow out all the sediment and a small amount of wine with it. The bottles should have been filled to within an inch of the cork, so that they will be sufficiently full after the sediment has been removed; then recork with new corks, driven in with a mallet, and wired or tied, and placed in racks on their sides, with their corks exposed, so that any leak can be detected and remedied with new corks.

In France the manufacturers of sparkling wine, in other districts than Champagne, have to increase its effervescence by mixing with it the wine grown in Champagne, which is a natural sparkler. Mr. Flagg, of Cincinnati, himself an experienced wine-grower, in his "Three Years in European Vineyards" expresses the opinion that the Scuppernong is as good a natural sparkler as is needed in this country.

It it stated in the Carolina Farmer, on the authority of Mr. G. W. Page, a successful manufacturer of Scuppernong wine, that before the rebellion a large part of the yield of the vines in the Pamlico and the Albemarle regions was collected in expressed juice by Mr. Longworth's agents, to impart flavor and a bouquet not otherwise attainable to his celebrated Cincinnati wines.

To make a fine still wine, it must be racked off in February or March, into clean, sweet barrels, and a pint of Scuppernong brandy added to each gallon; the bung should be left loose for two weeks, so that the slight amount of gas formed during the second fermentation may pass off; then bung up tight; and at the end of a year you have a fine aromatic wine, of a delicious flavor and bouquet.

THE WINE-MAKER'S MANUAL. By Charles Reemelin, author of the Vine-Dresser's Manual. 123 pages. Cincinnati: Robert Clarke & Co. 1868.

Mr. Reemelin has been a practical wine-grower at Cincinnati for many years, and has given in this treatise the result of his own experience in the business, as well as the most reliable information from recent foreign publications.

It covers the whole subject from the ripening of the grapes; their picking and culling; mashing; management of the must; fermentation; bottling; manufacture of sparkling, frozen, and spiced wines; wines from other fruits than the grape; imitation and artificial wines, with remedies for their various ailments, &c. It is written in a clear, intelligible style, meeting the wants of the household rather than the wine-shop, and suggests all the proper uses of grapes, and their refuse, in accordance with the general economy of rural practice. To give permanence to the production of wine, and to improve its quantity and quality, it is important that wine-growers should be well acquainted with all the ruling facts, tools, and manipulations of the business.

Mr. Reemelin advocates the proper and reasonable use of wines, and thinks they have civilized far more people than they have brutalized, and that, in fact, very few barbarians, but all civilized people, use them. Whiskey, the emblem of brutality, has unfortunately become our national liquor, which he hopes will be displaced by a more general use of native wines. He says that after all wine is but a liquid in which the substance of the fruit is presented to man in a more concentrated, more easily preserved and housed, and more digestible form. "That abuses have grown up, and that what was originally introduced for purposes of nutrition has become a means of pleasure on festive occasions, and also of dissipation and intoxication, is no argument against the propriety of wine-making. For if the liability to abuse would be ground against the use of human aliments, there is nothing so sacred nor so profane but that it might then be forbidden. Human life must not be dwarfed into the minimum to which such asceticism would reduce it; on the contrary, we must strive for that maximum of enjoyment which is consistent and in harmony with our peculiar natural necessities. Physical gratification is not in itself vice, nor is mere abstinence virtue. Man stands highest, morally, wherever he produces and consumes the greatest amount of those physical means which are necessary and proper for his own existence and that of his posterity. An experience backed by habits historically recorded for at least four thousand years, has entered wine in the list of necessary and proper means of subsistence for human beings, and we have, therefore, no hesitancy in doing our share toward facilitating wine-production as well as wine improvement. * * *

"A glass of wine, cider, or other fruit-wine, is exactly the food suitable to a tired condition. It furnishes that which requires least work from the stomach for assimilation. It does it quickly, which is a great consideration, and it satisfies the more interior parts of the system, which, therefore, cease to importune the stomach. Wines are better than distilled alcohol, because they contain more of the ingredients necessary for the human system, in the vegetable acids, salts, ethereal oils, and nitrogenous substances, and proportionally less alcohol, and that in a less stimulating form.

"The reader will now be able to discriminate between a proper and an improper use of wines. When employed in aid of other food, and used with it, it is proper; while using it as the principal or only aliment, or worse still, as a daily or hourly stimulant, it is improper."

FIELD, FOREST, AND GARDEN BOTANY: A simple Introduction to the Common Plants of the United States, east of the Mississippi, both wild and cultivated. By Asa Gray Fisher, Professor of Natural History in Harvard University. 12mo., 386 pages. New York: Ivison, Phinney, Blakeman & Co.

This book is intended to furnish botanical classes and beginners generally with an easy introduction to the plants of this country, the cultivated as well as the native species, and to provide cultivators, gardeners, and amateurs, and all who are fond of flowers, with a simple guide to a knowledge of their botanical names and structure. Within the compass of about 350 pages will be found brief botanical descriptions of 2,650 species, belonging to 947 genera. It thus supplies a great want to botanists and botanical teachers, whose only recourse in such cases heretofore has been a botanical library beyond the reach and means of many students. The book has been brought within the proper compass by compact printing, the rigid exclusion of all extraneous and unnecessary matter, by concise and simple language, and by the omission of obscure, insignificant, or rare plants, which students will not be apt to examine, or which are quite too difficult for beginners.

PRACTICAL FLORICULTURE: A Guide to the Successful Cultivation of Florists' Plants, for the Amateur and Professional Florist. By Peter Henderson, author of "Gardening for Profit." 12mo., 250 pages. New York: Orange Judd & Co. 1868.

Hitherto most of our books on horticulture have been mainly compiled from English writers, and are really of no great value in our country. Mr. Henderson has cut loose from all foreign authorities, and gives the methods of his own successful practice. Many of his views will be considered radical by the old school of foreign gardeners, but he points to the results of his methods, and lets others judge whether or not they are worthy of imitation. The book comprises full instructions for laying out ornamental grounds, lawns, and gardens; the management of cold frames and hot beds; the construction of green-houses and the modes of heating; the propagation and culture of hardy, tender, and bulbous plants; the tasteful construction of bouquets and hanging baskets; remedies for injurious insects, with lists of the most desirable plants for out-door, green-house, and stove or hot-house culture, closing with a diary of actual operations in his green-houses and gardens for every day in the year 1867–'68.

To show the public appreciation of the trade of commercial florists about our large cities, it may be mentioned that in New York, during winter, the common price for a handsome rose-bud is twenty-five cents, and the same for a dozen violets; while camelias vary from one dollar each, when scarce, to twenty-five cents, when plentiful; and at Christmas and New Year's the latter are frequently sold at two to three dollars each; common hand bouquets range from fifty cents to five dollars; extra fine ones, ten, fifteen, and even twenty dollars each; baskets of cut flowers, five to twenty-five dollars; bouquets for refreshments and dinner tables, five to fifty dollars, sometimes one hundred dollars; and on one great occasion a florist is said to have furnished three thousand dollars' worth of bouquets, wreaths, and other floral decorations for a private entertainment; and orders for two hundred to three hundred dollars on such occasions are not unfrequent. Funeral ornaments are also an important branch of the florist's trade, wreaths, crosses, anchors, and other floral emblems being now in common use, among the better class of society, to the amount of a hundred, and even a thousand dollars, for a single funeral. This floral business in New York now amounts to hundreds of thousands of dollars annually.

Mr. Henderson has views of his own on many of the old dogmas of foreign gardeners, and appeals to his success for their correctness. For instance, some English authorities call for nineteen different kinds of soil for potting plants. He simplifies matters by having one large heap of potting soil, composed of only two ingredients—rotted sods from a loamy pasture and rotted refuse hops from the breweries, in the proportion of two of the sods to one of the hops; if the latter are not attainable, thoroughly rotted horse or cow manure, or leaf mold from the woods, will do nearly as well. From this mold-heap vigorous plants of every description are grown and flowered with complete success. Special soils have less to do with the healthy growth of plants than the proper application of heat and moisture. Another dogma, that rain or soft water is necessary in watering plants in green-houses, he scouts emphatically; some of his green-houses are watered, summer and winter, from a deep well of the hardest water at an average temperature of 40°, and some from cisterns filled from their roofs, without any perceptible difference in the growth or healthiness of his plants. He also contends that the time-honored practice of placing potsherds, chips, charcoal, oyster shells, &c., in the bottom of pots to facilitate draining, is wrong in theory and perfectly useless in practice, as the escape of moisture or draining from flower pots takes place almost entirely from the porous sides of the pot, which should never be glazed. He has dispensed with the "draining" of flower pots for fifteen years, and in that time has raised millions of plants, which have not seemed to suffer from this deviation from the old orthodox system. In his annual importation of English novelties the flower pots always come filled one-third full with the inevitable potsherd, &c. The hole in the bottom of the pot should be stopped with a chip, or whatever is at hand, not for the purpose of drainage, but to prevent the soil from shaking out.

Mr. Henderson also protests against the generally received notion that plants in parlors or sleeping-rooms are injurious to health. Physicians may correctly assert that plants give out carbonic acid gas, yet that it is emitted in sufficient quantities "to affect our health in the slightest degree is utter nonsense." In proof of this, he says there is no healthier class of men to be found than greenhouse operators, many of whom are shut up in their houses all day and a large part of the night in winter, which, from their warmth, have to serve as sitting-rooms, and frequently as their bed-rooms. For three winters Mr. Henderson himself had charge of a hot-house rank with tropical vegetation, and slept on the floor, just the place to inhale the gas, if there had been much to inhale, without the least injury to his health.

The tasteful arrangement of cut flowers for decorative purposes is quite an art. "The simplest, easiest, and commonly the most desirable method is to arrange them in vases, the more loosely and unconfined the better. Crowding is particularly to be avoided, and to accomplish this readily a good base of greens is required to keep the flowers apart. This filling up is a very important part in all bouquet-making, and the neglect of it the greatest stumbling block of the uninitiated. Both spiked and drooping flowers, with branches and sprays of delicate green, are indispensable to the grace and beauty of a vase bouquet. To preserve the individuality of flowers, which is of the greatest importance, the placing together of those of similar size and form ought to be avoided. Thus Heliotrope, Stevia, Eupatorium, or Alyssum, when combined, lose their distinctive beauty; but if placed in juxtaposition to larger flowers, and those of other forms, their beauty is heightened by contrast. As a rule, small flowers should never be massed together. Large flowers

with green leaves or branches may be used to advantage alone, but a judicious contrast of forms is most effective.

"Nothing is so strikingly beautiful on a refreshment table as a handsome center-piece of flowers. All the airy castles of the confectioner are passed over by the eye, which is at once arrested and refreshed by the brilliant beauty of the products of the garden or conservatory; and we wonder how any person of taste, who possesses the means, should ever fail to have flowers on his table when entertaining friends. Considering the effect, flowers on the table, like plants in the garden, are certainly the cheapest of ornaments. There are those who would have nothing upon their tables but what they can eat or drink; like a gentleman who once employed the writer of this to lay out a new garden, and objected to having roses planted by the fences, saying very earnestly: 'Ah, yes! I suppose they are very pretty, but then, you see, we couldn't get anything from them to eat. Guess we won't have any of them things.' Luckily for the well-being of humanity, such desperately practical men are not very numerous."

THE BOOK OF EVERGREENS: A Practical Treatise on the Coniferæ, or Cone-bearing Plants. By Josiah Hoopes, member of the Academy of Natural Sciences of Philadelphia. 12mo., 435 pages. Illustrated. New York: Orange Judd & Co., 1868.

This is the first complete American work on conifers that gives a description of all the different species and varieties that will endure the climate of the middle States. It is written with an earnest love of the subject, and comprises not only the result of the author's own practical experience, but the latest information from European writers. It may be relied upon as a standard authority, and will prove invaluable to persons in making a selection of evergreens for their grounds.

An introduction, giving a general description of the most remarkable cone-bearing plants, is followed by practical directions on the proper soil, and mode of planting them, their propagation, pruning, and after-culture; the management of evergreen hedges, the situation and selection of varieties, with a strict scientific as well as popular description, in which the history, uses, and associations of the various pines, larches, firs, hemlocks, yews, cypresses, cedars, and the new conifers lately brought into notice by zealous collectors, are told in an attractive manner.

The surpassing beauty of the California pines is unexcelled, and some of the grandest specimens of evergreens in the world have been discovered in the valleys of the Rocky Mountains, and in the northwest parts of North America, along the coast, from the latitude of forty-three to fifty-two degrees. The size of some of these trees is immense, the Douglas Spruce (*Abies Douglasii*) ranging from one hundred and fifty to two hundred feet in height, and two to twelve feet in diameter. But the great tree of California (*Sequoia gigantea*) is the giant of all forests; it is very abundant on the western flanks of the Sierra Nevada, latitude 36° or 37°. Professor Brewer describes one as being two hundred and seventy-six feet high, and thirty-five feet in diameter. They impart a grandeur to the scenery, where, in some places, a hundred trees can be seen at once, over fifteen feet in diameter, covered with the richest foliage. Further north, still larger trees are found, which are the wonder of the botanical world. Bayard Taylor, after a graphic account of the immense size of these vegetable giants, describes the felling of one of the largest specimens, a mass of solid wood ninety feet in circumference, which was performed by two sets of hands, with the aid of two long pump augers: "After a steady labor of six weeks the thing was done, but the tree stood unmoved; so straight and symmetrical was its growth, so immense

its weight, and so broad its base, that it seemed unconscious of its own annihilation, tossing its outer branches derisively against the mountain winds that strove to overthrow it. A neighboring pine of giant size was then selected, and felled in such a way as to fall with full force against it. The top shook a little, but the shaft stood as before; finally the spoilers succeeded in driving their wedges into the cut. Gradually and with great labor one side of the tree was lifted; the line of equilibrium was driven nearer and nearer to the base; the mighty mass poised for a moment, and then, with a great rushing sigh in all its boughs, thundered down. The forest was ground to dust beneath it, and for a mile around the earth shook with the concussion.

"According to the annual rings, the age of this tree was 3,100 years, and it contained 250,000 feet of timber. The stump is now used for a ball-room, and the trunk for a bowling alley. Dr. Bigelow says of this specimen, that it required thirty-one of his paces, of three feet each, to measure thus rudely its circumference at the stump; and the mere felling of it cost, at California prices, $550. When we consider the sublime proportions of these wonderful productions of nature, all other trees sink into perfect insignificance. Just imagine a man on horseback riding a distance of seventy-five feet in the hollow of a tree, and emerging from a knot-hole in the side."

Two specimens of this wonderful tree are growing in the public grounds at Washington; one in front of the Agricultural Department, the other in the yard of the Department of the Interior, where it has flourished, unprotected, for several years. A plank seven and a half feet wide, of one variety of this tree, brought from California, and wrought into a handsome table, is in the museum of the Agricultural Department. The wood is of a red color, fine and close-grained, admitting of a high polish.

The Noble Silver Fir (*Abies nobilis*) is also a magnificent production of our hemisphere, growing two hundred feet high, on the Shasta Mountains. Downing described a specimen to be seen in the arboretum at Chatsworth, England, some forty feet high, of extremely elegant proportions, and beautiful in shape and color.

The Great Silver Fir (*Abies grandis*) is another superb tree, from California. It is found on the banks of Fraser's River, two hundred and eighty feet high, and five feet in diameter, presenting a tall, naked shaft of one hundred feet before branching. Mr. Hoopes has grown this in his grounds at West Chester, Pennsylvania, for ten years, in the open air, entirely unprotected, where it has withstood the most severe cold and intense heat, with unvarying success, and says no one of the new and rare conifers that he has tested exceeds this in his estimation. There are many other specimens of conifers on the western slope of the Rocky Mountains that are unsurpassed in size and beauty.

Mr. Hoopes closes his instructive and interesting work with notices of the best collections of conifers in the Union.

POPULAR DECIDUOUS AND EVERGREEN TREES AND SHRUBS FOR PLANTING IN PARKS, GARDENS, CEMETERIES, &c. By F. R. Elliott, Landscape Gardener and Pomologist, Author of "Western Fruit Book," &c. 12mo., 125 pages. New York: F. W. Woodward, 1868.

The great attention paid in the last few years to planting out trees and shrubs in public and private grounds, country roads, and the streets of cities, has created a demand for a practical treatise on the subject. Mr. Elliott has given this work to the public, describing the prominent habits of the leading evergreen and deciduous trees and shrubs, with their proper soils, exposition, and their landscape effect. The

deciduous trees, a rich collection of the maples, magnolias, larches, oaks, lindens, elms, birches, &c., as well as several weeping varieties of the willow, ash, elm, and other trees, are first described, and their peculiar management set forth. Two chapters are devoted to the evergreen trees and shrubs, which are becoming more highly appreciated every year, since it is ascertained that they can be transplanted about as safely as deciduous trees. Fifteen varieties of the pine are described, as well as several firs, spruces, and cedars, including the mammoth red tree of California, (the *Sequoia gigantea*,) whose average height in its native locality is two hundred feet, quite straight and clear of branches to the height of sixty or seventy feet. It grows rapidly in almost any soil, and may yet become a valuable timber for planting in the South and West. The remainder of the book is devoted to the various ornamental shrubs with which our country abounds. In planting shrubs, besides understanding what soils and situations are the best for their luxuriant growth and development, cultivators are reminded that flowers continue but a short period in comparison with the duration of the leaves, and therefore the more permanent picture should be executed by judiciously contrasting the green. Even the effect of perspective may be considerably increased by the proper arrangement of hues. Shrubs the leaves of which are of a gray or blueish tint, when seen over or between shrubs of a yellowish or bright green, will seem thrown into the distance. Those, again, with small or tremulous leaves should wave over or before those with large, broad, fixed foliage.

The author has endeavored to describe plainly each tree and shrub, with its adaptation to positions and soils, so that the novice in tree-planting may read and understand, and thereby advance the beauty of our roadsides, cemeteries, and private grounds.

THE TIM BUNKER PAPERS: Or Yankee Farming. By Timothy Bunker, Esq., of Hookertown, Connecticut. 12 mo., 314 pages. New York, 1868: Orange Judd & Co. 1868.

These papers, nearly one hundred in number, convey agricultural information in the attractive form of sketches of character and conversation. They were begun in the interest of improved husbandry, and were originally scattered through twelve volumes of the American Agriculturist. Though written without much method, they abound in humor and practical suggestions on the thousand objects that make up a farmer's life. Artificial manures, the cattle disease, sub-soiling, horse-racing, management of cattle, draining, irrigation, the eight-hour law, bad water, starting a sugar mill, keeping a wife comfortable, and kindred subjects are discussed in a style replete with Yankee pleasantry, while the teachings are in harmony with the best authorities in farming and horticulture.

RURAL AFFAIRS: A practical and copiously illustrated Register of Rural Economy and Rural Taste, including Country Dwellings, Improving and Planting Grounds, Fruits, and Flowers, Domestic Animals, and all Farm and Garden Processes. By J. J. Thomas, author of the "American Fruit Culturist," and "Farm Implements," and associate editor of the "Cultivator and Country Gentleman." With 400 engravings. Vol. IV. 12mo., 330 pages. Albany: Luther Tucker & Son.

AMERICAN AGRICULTURAL ANNUAL: A Farmer's Year Book. Exhibiting recent progress in Agricultural Theory and Practice, and a Guide to Present and Future Labors. Illustrated. Small 12mo., 150 pages. New York: Orange Judd & Co.

These two works are quite similar in character. The first named is published triennially, and is composed of articles that appear first in the Annual Register of Rural Affairs, and contains an immense amount of practical information on farming, horticulture, and rural affairs, embrac-

ing orcharding, rural architecture, flower and kitchen gardening, entomology, poultry, bees, household economy, &c. It is written almost entirely by Mr. Thomas, and is illustrated by over four hundred engravings, which increase the usefulness as well as the beauty of the work.

The Agricultural Annual is also handsomely illustrated, and aims to keep the public informed in regard to the progress made in the science of agriculture. Besides a calendar of farming operations for each month, it is filled with articles judiciously selected, and several original essays on veterinary matters, cattle diseases of the United States, trout culture, coal tar and its uses, breeding and management of swine, the comparative yield and tendency to rot in upwards of one hundred varieties of potatoes; also the progress of invention and introduction of new agricultural machinery, illustrated; with a list of agricultural journals, and a farmer's directory, comprising a classified list of manufacturers and dealers in agricultural implements, seeds, fertilizers, &c., and breeders of live stock, horses, cattle, sheep, swine, goats, poultry, bees, and fish.

THE MARKET ASSISTANT: Containing a brief description of every article of Human Food sold in the public markets of New York, Boston, Philadelphia, and Brooklyn, including the various domestic and wild animals, poultry, game, fish, vegetables, fruits, &c., with many curious incidents and anecdotes. By Thos. F. De Voe, author of The Market Book, &c. 12mo., 454 pages. New York: Hurd & Houghton. 1867.

This work aims to be practically useful as well as interesting, bringing together all those items of information necessary in catering for a household, in regard to domestic or tame animals, wild animals or animal game, poultry, wild fowl, and birds or bird game; fish, vegetables, fruits, nuts, dairy and household products, &c., connected with our daily wants. "What shall we have for dinner to-day? What is there in our markets fit to eat? What kind of meats, poultry, game, fish, vegetables, and fruits are in season? What names are given to the different joints of meats, and what dishes are they severally and generally used for? We have had roasts, steaks, and chops, and chops, steaks, and roasts, until we are tired of them! Now, do say, what shall we have for dinner?"

These, with many other exclamations, are daily discussed, and are comprehensively answered in this book. Mr. De Voe has been a leading butcher in the New York markets for thirty years, and has amassed a large amount of curious and interesting information. His work is not only replete with suggestions on selecting one's daily supplies in market, but on nearly every page will be found some amusing fact or anecdote bearing on the subject. In describing the game in the New York markets, appropriate extracts from the game laws are quoted; and in speaking of birds, he enters a strong protest against their wanton slaughter, as they "destroy millions of insects, flies, worms, slugs, &c., penetrating every nook and corner of hedge, thicket, or field; they clear bush and tree, limb after limb, while every passing leaf, folded or withered, is carefully examined and deprived of its concealed but destructive tenant. Without these useful and beautiful little trespassers, the many destructive insects would increase so rapidly as to become almost a plague, by destroying all fruit and vegetation; while the loss of a little fruit or seed for their subsistence for a short period would be ample payment to the birds for their great services to the cultivator.

"Birds do not often touch the sound fruit when they can find that containing worms. From this fact they should not be driven from the fruit trees; they are friends and benefactors, not only to the cultivator, but to mankind at large, and to all who have a sentiment for all that is beautiful, poetic and most musical of nature's productions."

The chapter on fish, descriptive and historical, is particularly interesting; and, from the nature of the subject, is enriched with many marvellous stories, but which generally appear to be well authenticated.

FARM IMPLEMENTS AND FARM MACHINERY, AND THE PRINCIPLES OF THEIR CONSTRUCTION AND USE: With simple and practical explanations of motion and force as applied on the farm. With 287 illustrations. By John J. Thomas. 12mo., 302 pages. New York: Orange Judd & Co. 1868.

This work is based on a prize essay, published in the transactions of the New York Agricultural Society for 1850, under the title of "Agricultural Dynamics; or, the laws of motion and force as applied to the ordinary practices of farming." This new edition embraces a description of all the valuable improvements that have been made in farm machinery, of nearly every kind, for the last twenty years. A large part of it is devoted to a practical explanation of the principles of mechanical science, as applied directly in the farmer's daily routine, that he may know the *reasons* of success and failure, instead of being guided by random guessing.

In his introductory chapter, Mr. Thomas describes the great improvement that has been made in common farm implements, and the new machinery invented within the last fifty years: "Plows turn up the soil deeper, more evenly and perfectly, and with greater ease of draught; hoes and spades have become lighter and more efficient; grain, instead of being beaten out by the slow and laborious work of the flail, is now showered in torrents from the threshing machine; horse-rakes accomplish singly the work of many men using the old hand-rake; horse-forks convey hay to the barn or stack with ease and rapidity; twelve acres of ripe grain are neatly cut in one day, with a two-horse reaper; grain-drills and planting machines, avoiding the tiresome drudgery of hand labor, distribute the seed for the future crops with evenness and precision.

"The owner of a seventy-thousand acre farm in Illinois carries on nearly all his work by labor-saving machinery. He drives posts by horse-power; breaks his ground with Comstock's Rotary Spader; mows, rakes, loads, unloads, and stacks his hay by horse-power; cultivates his corn with a two-horse seated or sulky cultivator; ditches low ground, sows and plants by machinery; so that his laborers ride in the performance of their tasks without exhausting their strength with needless walking over extended fields.

"The great value of improved farm machinery to the country at large has been lately proved by the introduction of the reaper. Careful estimates determined that the number of reaping machines introduced throughout the country, up to the beginning of the great rebellion, performed an amount of labor while working in harvest nearly equal to a million of men with hand implements. The reaper thus filled the void caused by the demand on working men for the army. An earlier occurrence of that war must, therefore, have resulted in the general ruin of the grain interest, and prevented the annual shipment of the millions during that gigantic contest, which so greatly surprised the commercial savans of Europe."

A sketch of the general principles of mechanics, and their application in the construction of implements and machinery, is followed by an illustrated description of those in use at the present day. The principles of road-making, in which all farmers are interested, are discussed; and the importance of good roads as affecting the price of land by affording facilities for easily reaching market, and for all other kinds of commu-

nication, are illustrated in a striking manner. The luxuriant crops of our western prairies, within a few years, have been left to decay on the ground, for want of easy roads to market; the rich mines of northern New York are comparatively valueless, because the mountain roads are so few and bad that the expense of transportation would exceed the value of the metal; and, in Old Spain, wheat, after abundant harvests, is left to rot on the ground, because it will not pay the cost of carriage. Government having once ordered the transfer of 480 tons of wheat from Old Castile to Madrid, 30,000 horses and mules were required; while on a good, broken-stone road, one hundredth part of that number could easily have done the work. The great military roads constructed in the highlands of Scotland by Marshal Wade after the rebellion of 1745, did more for the civilization of the Highlanders than all the other efforts of the British government; and the later roads built in Great Britain, under the direction of Telford, have produced changes in the condition of the people which are unparalleled in the history of any country; large crops of wheat now cover former wastes; farmers' houses and herds of cattle now abound where was formerly a desert; estates have increased seven-fold in value, and the country has been advanced at least one hundred years.

The principles of draught as applied to wagons, plows, &c., and the proper construction and use of farm implements and machinery for sowing, haying, harvesting, and threshing, are described with clearness; so, also, machinery used in connection with water, as hydraulic-rams, various kinds of pumps, turbine wheels, &c., and machinery in connection with air and heat, as windmills and ventilators; with suggestions on the proper construction of chimneys, cisterns, &c. Following this is a chapter on the radiation of heat, and the formation of dew and frost, with deductions on the best locations for such fruits and crops as may be injuriously affected by frosts. The book closes with the following remarks on the effects of heat and cold on water:

"The effects of heat and cold on water are of a very interesting character. Without its expansion in freezing the soil would not be pulverized by the frosts of winter, but would be found hard, compact, and difficult to cultivate in spring; without its expansion into steam, the cities which are now springing up, and the continents that are becoming peopled, through the influence of railways, steamships and steam manufactures, would mostly remain unbroken forests; without the crystallization of water, the beautiful protection of plants by a mantle of snow in northern regions would give place to frozen sterility; without the conversion of heat to a latent state in melting, the deepest snows would disappear in a moment from the earth and cause disastrous floods; without its conversion to a latent state in steam, the largest vessel of boiling water would instantly flash into vapor. All these facts show that an extraordinary wisdom and forethought planned these laws at the creation; and even what appears at first glance as an almost accidental exception in the contraction of bodies by cold, and which causes ice to float upon water, preventing the entire masses of rivers and lakes from becoming permanently frozen, furnishes one out of an innumerable array of proofs of creative design in fitting the earth for the comfort and sustenance of its inhabitants."

DRAINING FOR PROFIT AND DRAINING FOR HEALTH. By Geo. E. Waring, jr., Engineer of the Drainage of the Central Park, New York. Illustrated. 244 pages. New York: Orange Judd & Co.

In this volume the author has avoided everything which might be

construed into an approval of halfway measures in land draining, and takes a most radical view of the whole subject, urging the utmost thoroughness in all operations from the first staking of the lines to the final filling in of the ditches. He describes the kind of land that requires draining and the reasons for doing it; the action of drains and how they affect the soil; how to lay out and make a system of drains; their depth, distance, direction, cost, care, and profit; the proper use and kinds of draining-tiles and their manufacture; the importance and practicability of reclaiming salt marshes; closing with two important chapters on malarial diseases, and on house-drainage and town sewerage in their relations to the public health.

Land which requires draining gives sign of its condition, more or less clear, but always unmistakable to the practical eye. Standing water, or dark, wet streaks in plowed land, when all should be dry and of even color, feeble, spindling, shivering grain, sedge grass, coarse flags, and dank, miasmatic fogs, are all unerring indications of the necessity of drainage. To recognize these indications is the first office of the drainer; the second, to remove their causes.

All lands of whatever texture, in which the spaces between the particles of soil are filled with water within less than four feet of the surface, except immediately after heavy rains, require draining. A drain at the bottom of a wet field draws away the water from the free spaces between its particles, and its place is taken by air, while the particles hold by attraction the moisture necessary to a healthy condition of the soil.

There are vast areas of land that do not need draining: sands, gravels, light loams, and molds allow water to pass freely through them, and are sufficiently drained by nature, provided they are as open at the bottom as throughout the mass. There is, however, much land which thorough draining only will render profitable for cultivation or healthful for residence; and very much more described as "ordinarily dry land," which draining would greatly improve in both productive value and salubrity.

The surface indications of the necessity for draining are various. Those of actual swamps need no description; if a plowed field shows a constant appearance of dampness, indicating that as water is dried out of its upper parts more is forced up from below, so that after rains it is much longer than other lands in assuming the light color of dry earth, it unmistakably needs draining; a pit of three or four feet deep, that collects and retains water shortly after a rain, is a sure sign of the need of draining; if the water of heavy rains stands for some time on the surface, or if it collects in the furrow while plowing, draining is necessary to bring the land to its full fertility.

In dry weather other indications may be observed; as cracks in the soil, caused by the dryness of clays which previous soaking has pasted together; the curling of corn, showing that in its early growth it has been prevented by a wet subsoil from sending down its roots below the reach of the sun's heat, where it would find, even in the dryest weather, sufficient moisture for a healthy growth; and a certain wiriness of grass, with a mossy or moldy appearance of the ground, also indicate excessive moisture during some period of its growth.

Mr. Waring believes in the rule that "whatever is worth doing at all is worth doing well." He recommends that draining should not be confined to the wettest lands only; that drains should not be constructed with stones, or brush, or boards, nor horseshoe tiles used, because they are cheap, nor drains confined to removing the water from large springs; but that so far as draining is applied at all, it should be done in the most thorough and complete manner; and that it is far better, in commenc-

ing this improvement, that a single field be well drained than that the whole farm be half drained.

Of course there are farmers in some localities whose wet lands are not worth draining at present; this is particulary the case in the extreme West, where lands at their present prices are only worth relieving of their surface water. But lands near great markets, where it is better to cultivate small farms well than to buy more land for the sake of getting a larger return from poor cultivation, or wherever Indian corn is worth fifty cents a bushel on the farm, it will pay to thoroughly drain every acre which needs it.

An interesting chapter is given on the action of drains as they affect the soil in regard to absorption, evaporation, temperature, drought, porosity or mellowness, and chemical action, showing that while lands are thoroughly drained and improved, the operations of farming may be carried on with as much certainty of success, and with as much immunity from the ill effects of unfavorable weather, as can be expected in any business whose results depend on such a variety of circumstances; certainty will be substituted for chance in a great measure, and farming made an art rather than a venture. Full directions are given for laying out a system of drains, how to make them, their care, the requisite tools, cost, description of the different kinds of tiles, and their manufacture, with ample illustrations. Starting with a basis of sixty dollars as the cost of draining an acre of common farm land, the question "whether it will pay" is discussed, and numerous proofs given that it will. Mr. Johnston, a successful farmer in the wheat region of western New York, who has laid fifty miles of pipes within the past thirty years, says he never saw one hundred acres on any farm but a portion of it would pay for draining, and that tile draining will frequently pay for itself in two years. In 1847 he bought a lot of ten acres to get an outlet for his drains. It was a perfect quagmire, covered with coarse aquatic grasses, and so unfruitful it would not give back the seed sown upon it. It was thoroughly drained, and the next year a crop of corn taken from it which measured eighty bushels per acre. Another wet piece of twenty acres, which had never produced more than ten bushels of corn per acre, was drained at an expense of thirty dollars per acre; the first crop after this was eighty-three bushels and some odd pounds per acre. Mr. Johnston also gives satisfactory reasons for asserting that on drained land half the usual quantity of manure suffices to give maximum crops. Many other striking cases are given of the benefits of drainage in this country; and it is stated that since its general introduction in England (within the past twenty-five years) the aggregate wheat crop of the country has more than doubled. This increase, of course, is chiefly owing to bringing into use large areas of land originally unfit for cultivation; and large tracts which, before being drained, produced fair crops only in the best seasons, are now made very productive, independent of the weather. In fact, in the cultivation of heavy, retentive soils, drainage is the key to all improvement, and the foundation and the commencement of the most intelligent farming.

In the chapter on reclaiming salt marshes it is stated that hundreds of thousands of acres, forming a large part of the Atlantic coast from Maine to Florida, might be cheaply reclaimed and made fertile and salubrious. These marshes are now abandoned to the inroads of the sea, fruitful only in malaria and mosquitoes, always a dreary waste, and often a grave annoyance. Of such lands, 20,000 acres are to be found within seven miles of the heart of New York City, bordering on the Hackensack River, in New Jersey; they are a nuisance and an eye-

sore to all who see them or travel near them. The work of draining this tract would be child's play compared with the draining of the Harlem Lake in Holland, or the great fens on the eastern coast of England. Harlem Lake, comprising an area of over 40,000 acres, covered by the sea to an average depth of thirteen feet, was pumped dry, and the land thus reclaimed made to do its part in the support of a dense population. The expense, about $4,000,000, was more than repaid by the proceeds of the sales of the recovered lands.

The great fens of England, having an area of more than 680,000 acres, afford another instance of the beneficial effects of scientific draining. These fens, formerly a vast wild morass, with only small detached portions of cultivated soil, or islands occasionally appearing above the general inundation, formed a most deserted picture in contrast with their present state of matchless fertility and salubriousness.

Among the causes of "the chills," and remittent and intermittent fevers, undue moisture in the soil, producing malaria, is reckoned by medical authorities among the most prolific and sure. The proof that drainage is an efficient agent in removing the causes of malarious diseases is conclusive.

Instances of this are not so common in this country as in England, where drainage has been much more extensively carried out, and where greater pains have been taken to collect testimony as to its effects. In a chapter on the efforts now making in England to improve house-drainage and sewerage, as affecting public health, Mr. Waring concludes by stating that the principles of his book, whether relating to sanitary improvement, to convenience and decency of living, or to the use of waste matters of houses in agricultural improvement, are no less applicable in America than elsewhere; and the more general adoption of improved house drainage and sewerage, and of the use of sewage matters in agriculture, would add to the health and prosperity of its people, and would indicate a great advance in civilization.

EARTH CLOSETS: How to make and How to use them. By George E. Waring, Jr., author of "The Elements of Agriculture," and "Draining for Profit and Draining for Health;" formerly Agricultural Engineer of the Central Park, New York. 45 pages. New York: The Tribune Association. 1868.

In the twenty-fourth volume (for 1863) of the Journal of the Royal Agricultural Society of England will be found an article by the Rev. Henry Moule, of Fordington Vicarage, England, entitled "Earth *versus* Water, for the Removal and Utilization of Excrementitious Matter." The principle of his theory is based on the power of dried and sifted clay, and the decomposed matter found in the soil, to absorb and retain all offensive odors and all fertilizing matters. The importance of this principle, in both a sanitary and agricultural point of view, is well urged by Mr. Moule, who thinks that by its adoption the increased demand for fertilizing agents may be largely met; the health of towns promoted by the entire removal of the sewage nuisance, instead of its present mere palliation; and the pollution of streams and rivers prevented, the evil being no longer shifted from one quarter to another; and all this good secured without any of those vast and extravagant works for public drainage which add so greatly to the burdens of England.

Mr. Moule asserts that a very small portion of dry and sifted earth, say one pint and a half, is sufficient, by covering an excrementitious deposit, to arrest effluvium and prevent fermentation, (which acts so soon whenever water is used,) and the consequent generation and emission of

noxious gases; and that if, within a few hours or even a few days, the mass that would be formed by the repeated layers of deposit be intimately mixed by a coarse rake or spade, or by a mixer made for the purpose, then in five or ten minutes, neither to the eye or sense of smell is anything perceptible but so much earth.

The practical use of this discovery is as free to all as is the earth itself, and any person may adopt his own method of applying it. All that is necessary is to have a supply of prepared earth, partaking of the nature of clay, to absorb and retain ammonia and other fertilizers, simply by drying it in flat pans on a cooking stove or range, or thinly spread on boards and exposed to the sun, then sifting it, with which to cover the bottom of the vessel to be used, and after use to cover the deposit. Ordinary garden soil is quite effectual; if clay soil be scarce, an admixture of coal-ashes or street-sweepings would not be objectionable. Sand will not answer. A small box of this earth and a tin scoop are sufficient to prevent the gravest annoyance of the sick-room, or of a privy situated near a dwelling.

But for constant and extensive use it is desirable to have a more convenient apparatus, something that requires less care and is less troublesome in many ways than the common water-closet. To this end the patented earth-closet, by Mr. Moule, is applicable; which is fully described in Mr. Waring's pamphlet, and illustrated by diagrams. It comprises a tight receptacle under the seat, a reservoir at the back for stowing dry earth, and an apparatus to measure out the requisite quantity and throw it upon the deposit.

The machinery of the earth-closets is more simple, less expensive, and less liable to injury than that of the common water-closet. The supply of dried earth to the house is as feasible as that of coals, and is more easily applied to the closet than water by a forcing pump; and to the commode it can be carried just as coal is to the chamber. After use it can be removed in either case by the bucket or box placed under the seat, or from the fixed reservoir, with less annoyance than that of the ordinary slop-bucket; in fact, with as little offense as in the removal of coal-ashes. For hospitals, slaughter-houses, barracks, factories, prisons, public schools, railway stations, urinals, &c., the invention is admirably adapted, and will do away with much of the uncleanliness and indecency that disgrace civilized society.

By means of this earth system one can have a privy immediately adjoining his house, and an earth-closet up stairs, from neither of which will proceed any offensive smell or noxious gas. Through this closet the removal of noxious and offensive matters in time of sickness, and of slop-buckets, would be easy, and, if properly supplied with earth, all effluvium would be almost immediately checked; the trouble would not be greater than women generally undergo at present, while the value of the manure would be an inducement to exertion. A closet used by a family of six persons would require about one hundred pounds of dried earth per week. The same earth, after being used, kept in a dry place for two or three weeks, will be perfectly inodorous, and may be used again four or five times, with the same deodorizing effect, the product increasing in value.

As it is difficult, in the present stage of the working of this system, to state the exact money value of the manure thus manufactured, a few instances are given of its practical application to the garden and the field, instead of a scientific analysis of its composition. In a half-acre garden near Erith, for twelve or fourteen years an annual application of stable manure had failed to produce anything like a crop. Neither peas,

celery, rhubarb, or parsnips would grow at all, and cabbages were dwarfed. At last, as an experiment, stable manure was abandoned, and earth from a closet used. The first sowing of peas was destroyed by a too liberal use. Grown wiser by experience, the gardener used less, and his barren garden was changed to a fruitful field. His peas grew seven feet high, and were covered with pods; and his cabbages grew so finely as to attract general attention. With six pounds of the closet earth forty dozen broccoli and savoys were planted on otherwise unmanured ground, and no plants could have grown finer. It was also applied to patches of mangolds, onions, turnips, &c., with the best results.

Observation and experiment suggest that as soon as the earth covers the deposit some manurial property of that deposit begins to impregnate it; and that when the deposit is wholly absorbed, the earth has in fact digested it, or reduced it to a form or state in which it can afford nourishment to the plant. The sooner, therefore, the root can reach it, the better.

The economy of the system does not depend solely on the money value of the manure manufactured, but in a great degree on dispensing with the large outlay which the water system of sewerage involves; an instance is given of a school in England, attended by three hundred scholars. It cost £70 to connect the water-closet with the sewers; less than £20 would have provided them with self-acting earth-closets. In many county jails it costs £50 a year to keep in order the water-closets, by which the manure of one hundred and fifty prisoners is wasted; apply the earth system, the repairs of which would not be £5 a year, and £200 would be annually saved to the county. The intelligent master of the Kingswood Reformatory, containing one hundred boys, expressed his conviction that he would be able to make £200 a year from his earth-closets, and at the same time prevent abominations in the way of offensiveness that can scarcely be told.

Mr. Moule remarks, in concluding his essay, that if one-fifth of the population of Great Britain were to adopt and thoroughly carry out this system, one million tons of manure, equal to guano, would be added every year to its fertilizers; and Mr. Waring quotes the assertion of Liebig, that the greatness of the Roman empire was sapped by the *Cloaca Maxima*, through which the entire sewage of Rome was washed into the Tiber. Mr. Waring pertinently adds, that "the yearly decrease of productive power in the older grain regions of the West, and the increasing demand for manure in the Atlantic States, sufficiently prove that our own country is no exception to the rule that has established its sway over Europe."

Since this important discovery has been introduced to the American public, experiments made with the earth-closet commodes at the Pennsylvania Hospital at Philadelphia have been so entirely satisfactory as to induce the senior surgeon to apply dry, sifted earth to absorb the stench of sickening exudations from old sores and offensive wounds (which the best ventilation and the usual disinfectants could not mitigate) with surprising success. Not only was the offensive odor entirely overcome, but the effect on the character of the wounds was astonishing; suppuration was reduced, the edges of the wounds lost their inflamed character, their intense pain was relieved, and a healthy granulation produced. Mr. Waring thinks it not too much to hope that even the pustules of small-pox must give up their pain and offensiveness at this magic touch of mother earth; and if it is true that contagion spreads from its exudations, not improbably the spread of this loathsome disease, as well as cholera, will be effectively checked.

A GUIDE TO THE STUDY OF INSECTS, AND A TREATISE ON THOSE INJURIOUS AND BENEFICIAL TO CROPS: For the use of Colleges, Farm-Schools, and Agriculturists. By A. S. Packard, jr., M. D., with upwards of Five Hundred Engravings. Part I, to V. 8vo., 64 pages each. Salem, Mass.: Press of the Essex Institute. 1868.

In this work are given the outlines of the study of insects, with descriptions of their mode of growth and metamorphoses; their habits, and the best methods of collecting, preserving, and arranging specimens in the cabinet; with descriptions of the injurious and beneficial insects; and the remedies against the attacks of the former. It is written in plain language, and as free as possible from technicalities. It describes and figures the insect enemies to wheat, corn, potatoes, onions, and other garden vegetables; bees, flowers, ornamental shade-trees and shrubs, as well as all the fine varieties of large fruits and berries now cultivated. The work is published every two or three months, in parts of 64 pages, of which five have reached us. It is handsomely printed, and when completed will contain upwards of five hundred illustrations.

The first part contains an account of insects as compared with their allies, the crustaceans and worms, and a more special account of their structure, how they walk, fly, breathe, &c., and reproduce their kind, and the anomalous mode of the reproduction of the plant-lice, the humble-bee, and the gad-fly. The second part relates to the geographical distribution, the geological history of insects, and their diseases, with directions for collecting, preserving, and arranging them in the cabinet. The third part is devoted to the Hymenoptera, comprising the habits of bees, wasps, ichneumon flies, saw-flies, &c. Parts four and five conclude the Hymenoptera, and commence the chapter on the Lepidoptera, describing the butterflies and moths, with their transformations into the army worms, the borers in fruit trees, grape vines, currant bushes, squash vines, &c.

From the parts already published, the reader can learn what insects are useful or injurious, and all that is known of their habits; and in the volume, when completed, the habits and structure of the honey-bee, ant, saw-fly, clothes-moth, the mosquito, gad-flies, wheat-midge, house-fly, flea, weevil, grasshopper, dragon-fly, &c., will be described in popular language, so that all may become acquainted with our common insects, injurious and beneficial.

AMERICAN FISH CULTURE: Embracing all the Details of Artificial Breeding and Rearing of Trout, the Culture of Salmon, Shad, and other Fishes. By Thaddeus Norris, author of the American Anglers' Book. Illustrated. 12mo., 304 pages. Philadelphia: Porter & Coates. 1868.

Within a few years great attention has been paid to the culture of fish in Europe, where food is becoming a question of vast importance. The French government has fostered this business chiefly for this reason, and to such purpose, that in a few years there will scarcely be an acre of barren water in the empire. In fact, in many places waste waters, formerly entirely barren, are becoming more productive than the same area of cultivated land. The fish ponds of Dembes extend over 20,000 acres. Not only fish, but oysters, cray-fish, and other crustaceæ are being multiplied by this new science. Experiments are even being made on the sea coasts to propagate and rear the finer kinds of turtles. The results of this liberal and judicious policy have not only been spread over France, but have reached all parts of enlightened Europe, and even Australia; and our own country is resorting to it with the hope of arresting the gradual extinction of valuable fishes, and restoring our failing and exhausted rivers to their former fruitfulness.

The New England States, by concerted legislation, have established a

joint commission in reference to the artificial propagation of fish, and hope to restock their rivers with the aristocratic salmon and the delicious shad, and their cool clear ponds and brooks with the spotted trout of rarest beauty and most delicate flavor; and to naturalize the turbot and other highly-prized fish of Europe. By the expenditure of a few thousand dollars, and the passage and rigid enforcement of judicious laws for the protection of the spawn and eggs of these valuable fish, they can be produced and sold cheaper than beef in our markets. Both the fresh and salt water species readily adapt themselves to new localities. Pickerel have been introduced into the ponds of Berkshire; the great pike of the northern lakes have been transferred to the Connecticut River; the salt-water smelt lives in various ponds near Boston, and in many parts of Maine; and the tautog within a few years has found a new home in Massachusetts Bay, north of Cape Cod.

Mr. Norris has given an interesting account of the measures now being taken by foreign governments and by our State legislatures, as well as by enterprising individuals, in regard to fish culture, besides full details on trout breeding, the culture of the salmon, shad, white fish, black bass, rock fish, eels, oysters, &c., and on the naturalization of fishes in new habitats. His chapter on the last subject is full of curious facts.

"As a class," says Mr. Norris, "farmers are far more favorably situated for the whole routine of breeding and growing trout than persons of any other occupation. As regards the first requisite, most of them have springs of more or less volume and of the proper temperature on their premises, and generally near their dwellings. Labor with them is cheap, and much can be done at different seasons of the year without interfering with their ordinary farm work, or hiring extra help. The employment of horses, carts, wagons, and men, which they keep of necessity, would therefore cause no expenditure, and fill up their leisure time. The little mechanism necessary could be done by any one of them having an eye for a straight line, and an aptness with square, mallet, chisel, saw, hammer, and jack-plane. The only outlay would be for lumber, and trout or spawn to commence with. Four men, with a span of horses, a plow, road-scraper, shovels, and hoes, would excavate and construct ponds of sufficient size, if the ground is not over stony, in less than ten days. If a farmer has no mechanical skill, a country carpenter, with the assistance of two farm hands, could put up a large hatching-house in a week. The time between corn-planting and the first plowing might be put in to advantage. After hay and oat harvest another turn at the ponds might be taken, and the lull after the crops were in would suffice to finish them. Winter, in which the farmer has little to do, would be pleasantly and profitably employed in attending to the hatching. He would have a certain supply of fish food from curds, and an occasional one from the animals he would kill. Using milk does not rob the butter-jar nor the pig-pen, as it can be turned into curd after skimming, and the whey can go to the slop barrel. This business can be made as much of an accessory to farming as keeping bees or poultry, and with no more labor. Trout are much less mischievous than the latter; they do not invade the garden, or a newly sown or planted field, and can always be found within their circumscribed bounds. * * * I deem it a branch of industry that should claim the attention of our national government. If the Department of Agriculture has no discretionary power to foster it, special legislation should be directed to it, and appropriations made for the purpose of experiments and its promotion."

FISHING IN AMERICAN WATERS. By Genio C. Scott. With one hundred and seventy illustrations. 12mo., 484 pages. New York: Harper & Brothers. 1869.

The author of the work says that his experience of many years in the practice of the gentle art has led him through so many scenes of beauty and loveliness that his book has been written and illustrated, that all the world might learn the enjoyments of angling. The recreations of the angler in America are portrayed in a genial manner, and a tribute paid to the temperate and independent class of men who follow for a livelihood the hazardous business of fishing on the broad seas. An interesting chapter is given on the general habits and senses of fishes. That they possess certain senses, intellectual as well as instinctive, is evident; they need them to avoid being devoured, and to aid them in capturing other fishes, their life being mainly spent in efforts to eat, and to prevent themselves from being eaten; the form of the eyes of nearly all fishes being convex, proves them to be near-sighted; and though they quickly detect the slightest motion, they lack the power to discriminate form; the fact that peculiarly scented baits attract fish proves that they have the sense of smell; and that they possess the faculty of hearing is evident from the anatomical structure of the head, and the fact that in small ponds and preserves they are often called to the shores by a whistle or a bell. Their fecundity is almost incredible, and the voracity of some of them most rapacious; a shark has been known to seek for prey some time after being split open and entirely eviscerated; he evinces no mercy for any living thing that inhabits the waters.

The various coast and fresh-water fishes are described and illustrated, with their haunts and associations. The commercial fisheries are next taken up, and the character and extent of the lake and the coastwise fisheries shown; the value of the mackerel caught and cured in Massachusetts and Maine for the last four years has averaged over $6,000,000 per annum; their cured cod-fish, smoked salmon, and halibut are known in most of the markets of the civilized world, and sell for over $4,000,000 annually. In Chesapeake Bay 1,600 vessels and 6,000 men are annually employed in the oyster business, and it is estimated that 50,000,000 bushels of this delicious bivalve are taken annually on the coast from Massachusetts to Virginia.

A very full account, comprising nearly 100 pages, is given of ancient and modern fish culture, with ample details for the artificial propagation of the trout, salmon, and other fish. The work closes with an abstract of the laws of New York and the Dominion of Canada for the protection of fish, game, and insectivorous birds.

THE AMERICAN STUD BOOK: Comprising full Pedigrees of all the imported thorough-bred Stallions and Mares, with their produce, including the Arabs, Barbs, and Spanish Horses, from the earliest account of racing in America to the end of the year 1867; also, all the native mares and their produce, alphabetically arranged; and pedigrees of all the native stallions whose dams have no names, with a full and copious Index to the Produce of the Mares. By S. D. Bruce, editor of the Turf, Field, and Farm. 8vo., 649 pages. Chicago: E. B. Myers & Co. 1868.

It is no very easy task to determine correctly the pedigrees of the blood-horses of America. Mr. Bruce has spent twenty years in gathering and arranging facts on the subject, from public and private records, and has sought to bring to light what was obscure, and to prove pedigrees hitherto received with doubt, and seems to have possessed great facilities and a laudable zeal on the subject. He says that, "born and reared in a section of country the most famous for its horses; thrown in daily contact with the most enthusiastic breeders of thorough-breds; raising, training, and running them himself, his knowledge of the blood

horse gave him confidence to pursue this study, and to publish the result of his labor with the utmost reliance on its general correctness.

"The detailed history of our horses is shrouded in so much obscurity that frequent attempts have been made to compile an American Stud Book, but each time the enterprise has been abandoned in despair. To search out the hidden roots or branches from the parent stems, to brush away the obscuring clouds, to drag the lost members of the ancestral tree from the mire to which carelessness had consigned them, to restore every root and branch of this ancestral tree, to eradicate long-accepted error, and to harmonize fact with fact, is the tedious work of years; and such has been the labor of the life of him who now gives this the first volume of the American Stud Book to the world. None but those who have inquired into the loose, obscure records of the past, have any idea of what a herculean task it has been."

The result of Mr. Bruce's labors is an immense accumulation of facts from the private records of nearly every breeder of importance, from files of anti-revolutionary newspapers, and from an extensive correspondence. The work is arranged on the plan of the English Stud Book; it is handsomely printed, in a stately octavo, and illustrated with twenty fine engravings of celebrated horses.

THE TROTTING HORSE OF AMERICA: How to train and drive him, with Reminiscences of the Trotting Turf. By Hiram Woodruff. Edited by Charles J. Foster, of Wilkes' Spirit of the Times, including an Introductory Notice by George Wilkes, and a Biographical Sketch by the editor. 12mo., 412 pages. New York: J. B. Ford & Co. 1868.

This book is prefaced by appreciative sketches of the author by Mr. Wilkes and Mr. Foster. Mr. Woodruff "belonged to a family of horsemen," his father and brother being famous as trainers of horses; and has been distinguished for his success in training and developing the best trotting horses of America. Mr. Wilkes ascribes to him "the development of the American trotter to its present marvelous pre-eminence over all other breeds of horses used for harness and road purposes." "Those who know the history of trotting in this country, and who recall to mind the average speed of the first harness-horse, when Mr. Woodruff identified himself with its advancement, will not hesitate to say that he doubled the value of the original element on which he worked, and at the end of a few years gave a *great* animal to the country in place of what had been only a *good* animal before."

The memoir is followed by practical directions on rearing colts, the characteristics of different breeds, and their management and development as trotters; with sketches, reminiscences, and gossip connected with the principal races that have taken place in the United States in the last half century.

HORSE PORTRAITURE: Embracing Breeding, Rearing, and Training Trotters, with their management in the Stable and on the Track, and Preparation for Races; including Histories of the Horse and Horsemen, with an Appendix, containing the performances of Dexter, and a Portrait by Scott. By Joseph Cairn Simpson. 12mo., 458 pages. New York: Townsend & Adams. 1868.

The subject-matter of this book is well described in its ample title-page. It is filled with details in regard to the breeding, breaking, and management of trotting horses; their preparation for the race-course, the pedigrees of famous racers, suggestions on the construction of stables, the proper style of bits, &c. Though rather diffuse in style, and

treating incidentally of many other subjects than horses, the work abounds with acceptable information to those particularly interested in fast trotters.

THE MULE: A Treatise on the Breeding, Training, and Uses to which he may be put By Harvey Riley, superintendent of the government corral, Washington, D.C. 12mo. 107 pages. New York: Dick & Fitzgerald. 1868.

"The mule, although the humblest member of the horse family, has been a useful friend of man, and has served him faithfully in war and peace. If he could tell man what he most needs, it would be, kind treatment." Mr. Riley has given the public a short treatise on the breeding, care, and management of these animals, the result of thirty years' experience in their use. As humanity, as well as economy, will be best served by kindness, he has made a strong plea for their more sensible and judicious treatment, comprising remarks on their breeding and raising; how colts should be handled, broke, and harnessed; the value of kind treatment; the color and peculiarities of mules; how they should be packed; their physical construction; their diseases and proper treatment.

In breaking the mule, patience is the great essential. "Take hold of him gently, and talk to him kindly. Don't spring at him; don't yell at him; don't jerk him; don't strike him with a club; don't get excited at his jumping and kicking; approach and handle him the same as you would an animal already broken, and through kindness you will, in less than a week, have your mule more tractable, better broken, and kinder, than you would in a month had you used the whip; but mules, with very few exceptions, are born kickers. Breed them as you will, the moment they are able to stand up and you put your hand on them they will kick. It is, indeed, their natural means of defense, and they resort to it by instinct. In commencing to break them, then, kicking is the first thing to guard against and overcome. Careful study of the animal's nature, and long experience with him, have taught me that in breaking the mule whipping and harsh treatment almost invariably make him a worse kicker. They certainly make him more timid and afraid of you; and just so long as you fight a young mule and keep him afraid of you, just so long will you be in danger of his kicking you. He must be convinced, through kindness, that you are not going to hurt or punish him; and the sooner you do this the sooner you are out of danger from his feet."

Mr. Riley was in command of one of the army corrals at Washington during the rebellion, and many thousands of mules were annually passed under his inspection; this gave him frequent opportunities for ascertaining the best color of the animal, many considering this a point of importance; but, with the exception of the cream colored, he thinks this no criterion. Mules of cream color are apt to be soft; they lack strength and can stand but little hardship, particularly those that have a white skin; iron grays are considered hardy; "avoid spotted or dapple mules; they are the very poorest animals you can get; they cannot stand hard work, and when once they get diseased and begin to lose strength there is no saving them; they have generally bad eyes, and in the heat and dust of summer many of them go blind." snow white mules are about as useless. In selecting mules, look well to the age, form, height, size of bone and muscle, and disposition. Get these right, and you will have a good animal; mare mules are more safe and trusty under the saddle, and are better than a horse mule for team purposes. Mules are not so apt to get frightened, lose their senses, and

run away, as is the case with horses. A horse that has once run away is never safe afterward; but bring a mule back in such a case, and generally he will not do it again; his sluggish nature does not incline him to such tricks. As a general thing, mules are not so well adapted for use in stages, omnibuses, and city railroads as horses, mainly because those having charge of them lack experience in their management. But they will do good service on the prairies supplying our army, towing canal-boats, and hauling cars inside of mines, where they can jog along and take their own time patiently. Such employment soon breaks down the spirit of a horse and renders him useless.

Mr. Riley closes his book with a chapter on the diseases of mules, (which are not materially different from those of horses,) with their proper remedies and modes of treatment.

THE DISEASES OF SHEEP EXPLAINED AND DESCRIBED: With proper Remedies to prevent and cure the same. By Henry Clok, V. S. 12mo., 146 pages. Philadelphia: Claxton, Remsen & Haffelfinger. 1868.

Mr. Clok is a graduate of the royal college at Berlin, Prussia, and was veterinary surgeon-in-chief of the United States army during the late rebellion. He gives a description of all the important diseases of sheep, external and internal, and of their treatment and prevention. Most of the diseases he has observed and treated himself, and their description and the directions for their cure and prevention are based substantially on his own observation. A few pages at the close of the book are devoted to some of the worst diseases of cattle, including the pleuro-pneumonia, or rinderpest, ascribing its spontaneous formation to several very different causes, as the unfavorable influence of the atmosphere, especially during the spring, mostly in changeable, cold, and damp weather, when the animals take cold; to permanent feeding with artificial food; to spoiled food, such as sour, moldy, musty hay, rotten roots or bulbs; to drinking unclean water; to keeping them without exercise or motion, especially in overcrowded stables; to careless attendance to the animal, and want of cleaning the stables; to the importation of untanned hides, &c.; to cattle imported from other countries, particularly in times of war; and to low pastures with marshy bottoms.

That destructive disease, the sheep-pox, and the troublesome malignant foot rot, formerly so ruinous, are fully discussed. The former disease may appear at any season, like the human small-pox, and independently of all exterior influences or of the individual constitution of the animal, attacking young as well as old, healthy as well as sick animals. Its devastations have been enormous; out of 8,000,000 of sheep in Hungary, 150,000 are said to have been destroyed in one year; and it was officially reported that the loss amongst herds in Austria, aggregating about 16,000,000 of sheep, was not less than 400,000 per annum. This official report was made before vaccination for sheep-pox had been introduced. After these enormous losses, this remedy was thought of; and since its introduction sheep-pox has ceased to be a perpetual plague to whole countries, and only occurs amongst single herds or in limited districts.

The malignant foot rot formerly occasioned great loss among the best Spanish Merinoes, with which the disease was most common, but less so with half-breeds, and least with common sheep; the more common kinds being less liable, because their wool, skin, and hoofs are of coarser texture; while the delicate frame of the Merino is not so well fitted to resist the disease. Wet summers, or other causes which tend to soften the claws, as heat and moisture combined, or when sheep stand

closely together on warm dung in a stable, facilitate the spread of the disease, the seat of which is in the capsule of the claw. In its milder form it affects only the parts above the capsule of the hoof, seldom attacking the latter. Numerous remedies are applied to the extirpation of this disease, including the application of different acids and caustics; but although such sometimes effect a cure, they generally retard it, are expensive, painful, and difficult to apply. The proper mode of treatment is to cut out with a sharp narrow knife all the loose horn which is separated from the hoof and is suffused with matter; the object being to lay bare the diseased suppurating substances, and to destroy the infectious matter on them; for this purpose chloride of lime is the most rapid and efficacious of all remedies. It should be applied to the diseased surfaces, the cleft filled with tow, and a bandage applied to protect the hoof from dangerous external irritation. The diseased hoofs should be inspected daily, covered with chloride of lime, and bandaged anew if necessary. If a diseased spot is discovered which escaped notice before, a portion of the newly-formed hoof must be again removed with a knife. Two or three applications are generally sufficient for a cure. The pain and lameness soon disappear; the skin becomes thicker and more compact, every day forming the new horn. The foot rot being a purely local disease, general treatment and internal remedies are wholly useless. Good and copious food and occasionally salt licks, mixed with wormwood, tar, or oil of turpentine, are recommended. When the lameness has disappeared and a firm horn been renewed, the sheep can be returned to the healthy flock, after being made to walk through chloride of lime water, say by filling a long trough with cold water, into which a pound of chloride of lime is poured for every pail of water, and fenced in at the sides by a hurdle. Any virus clinging to the hoof is thus destroyed.

Veterinary science has probably made greater progress, in both theory and practice, in the last thirty years, than in all preceding time. Mr. Clok describes the causes and remedies of the various diseases peculiar to sheep in a style intelligible to non-professional readers, and closes with advice to all farmers and cattle owners, "to help themselves when possible, and employ a veterinarian in other cases."

AMERICAN WORKS ON AGRICULTURE AND RURAL ECONOMY.

The following list of American works on agriculture and rural affairs has been prepared with care, and will be found as full and accurate as the nature of the case admits. Reports on the geology of nearly all the States have been published, but these are not included in this list; neither are the annual transactions of State Agricultural Societies; nor reprints of foreign works, unless largely illustrated with notes by American writers:

Name of author.	Title and description of work.	Place and date of publication.
Adair, D. L.	New system of Bee-Keeping: with improved Methods of Artificial Swarming. 8vo	Cincinnati, 1867.
Adams, Daniel	The Agricultural Reader: For Schools. 12mo	Boston, 1824.
Adlum, John	Memoir on the Cultivation of the Grape. 12mo	Washington, 1823.
Agassiz, Louis	Methods of Study in Natural History. 12mo	Boston, 1863.
Allen, Harrison	Monograph on the Bats of North America. 8vo	Washington, 1864.
Allen, John F.	Practical Treatise on the Culture of the Grape. 12mo	New York, 1853.
Do	Victoria Regia. culture of the Great American Water Lily. folio	Boston, 1854.
Allen, Lewis F.	The American Herd Book. 8 vols., 8vo	Buffalo, 1846-66.
Do	Address before the United States Agricultural Society. 8vo	Albany, 1849.
Do	Rural Architecture: Illustrated. 12mo	New York, 1852.
Do	American Cattle: their History, Breeding, &c. 12mo.	New York, 1868.
Allen, R. H. & Co.	Illustrated Catalogue of Agricultural Implements. 8vo	New York, 1868.
Allen, Richard L.	Domestic Animals: their History, Breeding, &c. 12mo	New York, 1859.
Do	The American Farm Book: Illustrated. 12mo	New York, 1859.
	American Agricultural Annual for 1868. 12mo	New York, 1868.
	American Bird Fancier: How to raise Birds of all varieties. 12mo	New York, 1851.
	The American Fruit Book: Directions for raising the best varieties of Fruit. 18mo	New York, 1849.
	The American Farmer's Cyclopædia of everything relating to American Farming. 8vo	New York.
	The American Farmer's New and Universal Hand-book. 8vo	Philadelphia, 1857.
	The American Fowl Breeder. 18mo.	Boston, 1850.
	The American Florist's Guide: Every Lady her own Flower Gardener. 12mo	New York, 1852.
	American Husbandry: Soil, Climate, &c., with the Advantages and Disadvantages of Settling there. 2 vols. 8vo	London, 1775.
	The American Rose Culturist; with a List of the best varieties. 12mo	New York, 1852.
Anderson, C. F.	American Villa Architecture: How to build in the Country	New York, 1853.
Anderson, James	Essay on Quick Lime as a Manure. 12mo	Boston, 1799.
Appert, M	The Art of preserving Animal and Vegetable Substances. 12mo	New York, 1812.
Armstrong, John	Treatise on Agriculture; with Notes by Jesse Buel. 12mo	Albany, 1820.
Audubon, John J.	The Birds of America, from Original Drawings. 4 vols, folio	1828-40.
Do	Ornithological Biography of the Birds of the United States. 5 vols., 8vo	Philadelphia, 1831-39.
Do	The Birds of America; with a Description and Complete Illustration of each. 7 vols., 8vo	New York, 1844.
Do	Viviparous Quadrupeds of North America. 3 vols., 8vo	New York, 1846-53.
Do	The Quadrupeds of North America. 3 vols., 8vo	New York, 1852-54.
Baird, I. P.	The Mammals of North America. 4to	Philadelphia, 1859.
Baker, Charles R	Practical and Scientific Fruit Culture. 12mo	Boston, 1866.

American works on agriculture, &c.—Continued.

Name of author.	Title and description of work.	Place and date of publication.
Barclay, H.	Agricultural Tour in the United States and Canada. 12mo	Edinburgh, 1842.
Barnum, H. L.	The Farmer's Own Book of Receipts. 16mo	Boston, 1832.
Barnwell	The Game Fish of the Northern States and Canada. 12mo	New York, 1862.
Barry, P.	Treatise on the Fruit Garden: Planting, Pruning, Training and Gathering. 12mo	New York, 1852.
Bartlett, C. L.	Guano as a Manure: its History and Economy. 8vo.	Boston, 1860.
Barton, Wm. P. C.	The Flora of North America. 3 vols., 4to	Philadelphia, 1819-24.
Do	A Description of the Indigenous and Natural Plants within ten miles of Philadelphia. 2 vols., 12mo.	Philadelphia, 1818.
Bartram, John	Travels through Pennsylvania to Canada: Observations on the Inhabitants, Climate, Soil, Productions, &c.	London, 1751.
Bartram, William	Travels through the Carolinas, Florida, and Georgia: Describing their Natural Productions. 8vo	Philadelphia, 1791.
Beatty, Adam	Southern Agriculture: Essays on the Culture of Corn, Tobacco, Wheat, &c. 12mo	New York, 1843.
Do	Essays on Practical Agriculture. 12mo	Maysville, Ky., 1844.
Beck, Lewis C.	The Botany of the United States north of Virginia; a description of Flowering and Fern-like plants. 12mo	New York, 1848.
Beecher, Catharine E.	The Family Receipt Book. 8vo	New York, 1846.
Beecher, Henry W.	Fruits, Flowers, and Farming. 12mo	New York, 1859.
Bement, C. M.	The American Poulterer's Companion: Illustrated. 12mo	New York, 1857.
Do	The Rabbit Fancier: The Breeding, Rearing, and Diseases of Rabbits. 12mo	New York, 1857.
Benton & S. F. Barry	A Statistical View of the number of Sheep in New England, New York, Pennsylvania, and some of the Western States. 12mo	Boston, 1837.
Berneaud, Thebaut de	The Vine Dresser's Manual, Theoretical and Practical. 8vo	Philadelphia, 1843.
Bevan, Edward	Treatise on the Honey Bee. 8vo	Philadelphia, 1843.
Bigelow, Jacob	American Medical Botany. Illustrated. 3 vols., 8vo.	Boston, 1818-21
Do	The Plants of Boston and vicinity. 12mo	Boston, 1840.
[illegible], Dr.	Catalogue of the Medicinal Plants of Ohio. 8vo	Columbus, 1849.
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Blacklock, Ambrose	Treatise on Sheep: with a Chapter on Wool. 24mo.	New York, 1843.
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Blodget, Lorin	Climatology of the United States. 8vo	Philadelphia, 1857.
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Bonaparte, Charles L.	Natural History of the Birds of the United States, not given by Wilson; with Illustrations. 4 vols., folio	Philadelphia, 1825-33.
Bordley, J. B.	Comparative View of the Crops of England and Maryland. 8vo	Philadelphia, 1784.
Do	Sketches of a Rotation of Crops and other Rural Matters. 8vo	Philadelphia, 1797.
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Boswell, [illegible]	The Poultry Yard as it should be. 12mo	New York.
Breck, Joseph	The Flower Garden: describing the Management of Ornamental Plants. 12mo	New York, 1867.
Breuil, A. Du	Vineyard Culture; with numerous Notes and Adaptations to American Culture, by J. A. Warder. 12mo	Cincinnati, 1867.
Brickell, John	The Natural History of North Carolina. 8vo	Dublin, 1737.
Bridgman, Thomas	The Complete Florist's Guide. 12mo	New York,
Do	The Kitchen Gardener's Instructor. 12mo	New York, 1830.
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Do	The Fruit Cultivator's Manual. 12mo	New York, 1857.
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Browne, Daniel J	Sylva Americana: A Treatise on the Forest Trees of the United States: Illustrated. 8vo	Boston, 1832.
Do	The Trees of America, scientifically and popularly described: Illustrated. 8vo	New York, 1846.
Do	American Poultry Yard. 12mo	New York, 1850.
Do	The American Bird Fancier. 12mo	New York, 1851.
Do	The American Muck Manual: On the Nature of the leading Principles of Agriculture. 12mo	New York, 1852.
Do	Memoir on Indian Corn: To which is added "Barlow's Hasty Pudding"	New York, 1856.
Browne, Peter A	Essay on Hair and Wool: Breeding Sheep, &c. 4to.	Philadelphia, 1853.
Do	An Essay on Indian Corn. 8vo	Philadelphia, 1837.
Buchanan, Robert	Cultivation of the Grape; with an Appendix containing N. Longworth's Directions for Cultivating the Strawberry. 12mo	Cincinnati, 1852.
Buel, Jesse	The Farmer's Companion: Essays on American Husbandry; with Useful Tables. 12mo	Boston, 1830.
Do	The Farmer's Instructor: Essays and Hints on the Management of the Farm and Garden. 2 vols., 12mo	Boston, 1840.
Buist, Robert	The Family Kitchen Garden. 12mo	New York, 1852.
Do	The Culture of the Rose: Describing the Best Varieties. 8vo	Philadelphia, 1844.
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Bunker, Timothy, [Rev. Wm. Clift.]	Papers on Yankee Farming: From the American Agriculturist. 12mo	New York, 1868.
Burley, James	Grapes and Wine: A Visit to France and Spain. 12mo	New York, 1848.
Burr, Fearing, jr	The Field and Garden Vegetables of America. 8vo	Boston, 1864.
Burnham, G. P	History of the Hen Fever. 12mo	Boston, 1855.
Busby, James	Grapes and Wine. 12mo	New York, 1848.
Butler, Francis	Treatise on Breeding, Crossing, and Training Dogs. 12mo	New York, 1856.
Butler, Frederick	The Farmer's Manual: A plain Treatise on Husbandry. 12mo	Weathersfield, Ct., '21.
Caird, James	Prairie Farming in America; with Notes on Canada and the United States. 12mo	New York, 1859.
Campbell, J. L.	Manual of Scientific and Practical Agriculture. 12mo	Philadelphia.
Caradeuc, H. De	Treatise on Grape-Culture	Augusta, Ga., 1859.
Carey, Henry C	Harmony of the Agricultural, Manufacturing, and Commercial Interests. 8vo	New York, 1852.
Carson, J	Illustrations of Medical Botany. 2 vols., 4to	Philadelphia, 1847.
Casey, J. P	Treatise on the Various Forms of the Roots of Flowers	Baltimore, 1821.
Cassin, John	Synopsis of North American Ornithology. 8vo	Philadelphia, 1856.
Catesby, Mark	Natural History of Carolina, Florida, and the Bahamas. 2 vols., folio	London, 1754.
Do	The Trees and Shrubs of North America adapted to the Climate of England. 4to	London, 1733.
Chapin, L. D	The Vegetable Kingdom; or Hand-Book of Plants and Fruits. 16mo	New York, 1843.
Chase, C. T	The Prairie Fruit Culturist: For the Northwest. 16mo	Chicago, 1859.
Chaumont, J. Leray	Present Condition of Agriculture, at Home and Abroad. 8vo	Albany, 1826.
Child, David L	Culture of the Sugar Beet. 12mo	Boston, 1840.
Chorlton, Wm	The Cold Grapery; or How to grow Grapes under Glass. 12mo	New York, 1853.
Do	The Grape-Grower's Guide. 12mo	New York, 1856.
Christie, A. J	The Agricultural Interests of Canada. 12mo	Montreal, 1821.
Christie, David	The Geology of the West and Southwest. 8vo	Rossville, Ohio, 1848.
Do	Cotton is King; its Relations to Agriculture and Commerce. 12mo	Cincinnati, 1855.
Do	The Chemistry of Agriculture. 12mo	
Church, Edward	Treatise on the Culture of the Sugar Beet. 12mo	Northampton, Ms., '37.
Clark, John T. C	The Amateur's Guide and Flower Garden Directory.	Washington, 1856.
Clarke, John	Treatise on the Mulberry Tree and Silk Worm. 12mo.	Philadelphia, 1839.
Cleaveland, Parker	Agricultural Queries; [to the Farmers of Maine.] 8vo.	[Portland,] 1827.
Clok, Henry	The Diseases of Sheep; Cattle Epidemics. 12mo	Philadelphia, 1868.
Coates, B. H	Remarks on the Larvæ of the Hessian Fly. 12mo	Philadelphia, 1814.
Cobb, Jona. H	Manual on the Culture of the Mulberry and Silk Worm. 12mo	Boston, 1833.
Cobbett, Wm	A Year's Residence in the United States. 12mo	New York, 1818.
Do	The American Complete Gardener. 12mo	New York, 1825.
Coke, M. R	Treatise on Domestic Poultry. 18mo	New York.

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Do	The American Fruit Book. 12mo	New York, 1857.
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Do	Agriculture of the United States. 8vo	New York, 1841.
Do	Agriculture of France, Belgium, Holland, and Switzerland. 8vo	Boston, 1848
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Comstock, John L.	Readings on Zoölogy. 12mo	New York, 1853.
Comstock, T. G.	Practical Treatise on the Silk Worm. 12mo	Hartford, 1839.
Do	Complete Manual of Flower Gardening. 12mo	Philadelphia, 1844.
Conger, H. B.	Treatise on the Rinderpest	New York, 1867.
Copeland, R. M.	Country Life; Horticulture, Landscape Gardening &c.	Boston, 1859.
Coultas, Harland	Principles of Botany, as exemplified in the Cryptogamia. 12mo	Philadelphia, 1853.
Do	The Plant Illustration of the Organic Life of the Animal. 12mo	Philadelphia, 1855.
Coultas, Harriet	What may be learned from a Tree. 8vo	New York, 1859.
Coxe, William	Cultivation of Fruit Trees, and Management of Orchards and Cider. 8vo	Philadelphia, 1817.
Crevecoeur, J. H. St. John de	Letters from an American Farmer. 8vo	London, 1782.
Cronise, T. F.	The Natural Wealth of California; its Agriculture, &c. 8vo	San Francisco, 1868.
Custis, G. W. P.	The Importance of Encouraging Agriculture, &c. 8vo.	Alexandria, 1808.
Dadd, George H.	Advocate of Veterinary Reform, &c. 8vo	Boston, 1850.
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Do.	Practical Observations on the Diseases and Lameness of Horses. 12mo	New York, 1858.
Dana, Samuel L.	Muck Manual, for the Use of Farmers. 12mo	Lowell, 1851.
Do	Essay on Manures. 12mo	New York.
Darlington, Wm.	Agricultural Botany. 12mo	Philadelphia, 1847.
Do	Agricultural Chemistry. 12mo	Philadelphia, 1847.
Do	Flora Cestrica; the Plants of Chester Co., Pa. 12mo.	Philadelphia, 1853.
Do	American Weeds and Useful Plants; revised by Prof. Geo. Thurber. 12mo	New York, 1859.
Davis, Humphrey, jr.	The Cause and Cure of the Potato Disease. 8vo	New Bedford, 1855.
Davis, N. S.	A Text Book of Agriculture. 12mo	New York, 1850.
Deane, Samuel	The New England Farmer, or Georgical Dictionary. 8vo	Worcester, Mass. 1796.
Dearborn, H. A. S.	Monograph of the Camelia. 8vo	Boston, 1838.
De Caradue, A.	An Essay on Grape Culture. 12mo	Albany, 1865.
Denniston, G.	An Essay on Grape Culture in Steuben Co., N.Y. 12mo	Albany, 1865.
Derby, John	Manual of Botany. 12mo	Macon, Ga., 1841.
Dickerson, M. W.	Report on the Cypress Timber of Mississippi and Alabama	Philadelphia, 1848.
Disturnell, J.	Influence of Climate in North and South America, with Agricultural and Isothermal Maps of North America. 8vo	New York, 1867.
Dixon, Edmund S.	Treatise on Ornamental and Domestic Poultry. 12mo.	New York, 1859.
Downing, A. J.	Rural Essays; with Memoir by Geo. W. Curtis. 8vo.	New York, 1850.
Do	Architecture of Country Houses; their Furniture, &c. 8vo	New York, 1850.
Do	Cottage Residences; their Gardens and Grounds. 8vo.	New York, 1852.
Do	The Fruits and Fruit Trees of America. 12mo	New York, 1857.
Do	The Theory and Practice of Landscape Gardening. 8vo	New York, 1869
	Domestic Animals; A Manual of Cattle, Horse, and Sheep Husbandry. 12mo	New York, 1858
Draper, J. W.	Treatise on the Forces that Produce the Organization of Plants. 12mo	New York, 1844.
Drown, Solomon	The Farmer's Manual. 12mo	Providence, 1828.
Drown, William	Compendium of Agriculture. 12mo	Providence, 1824.
Ducatel, Julius T.	The Geology of Maryland. 8vo	Annapolis, 1838.
Du Hays, Charles	Treatise on the Percheron Horse; translated from the French. 12mo	New York, 1868.
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Eastwood, B.	Complete Manual for the Culture of the Cranberry. 12mo	New York, 1856.
Eaton, Amos, (and John Wright)	Botany of North America. 12mo	Albany, 1833.
Edgar, Patrick N.	The American Race Turf Register and General Stud Book. 8vo	New York, 1833.
Elder, W.	The American Cottage Gardener. 12mo	Philadelphia, 1849.
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Elliott, Daniel G	The Birds of North America. Folio	New York, 1868.
Elliott, F. R	The American Fruit-grower's Guide. 12mo	New York, 1854.
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Elliott, Stephen	Botany of South Carolina and Georgia, 2 vols., 8vo.	Philadelphia, 1821.
Ellsworth, H. W	Illinois in 1837; Cultivation of the Prairies. 8vo	Philadelphia, 1837.
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Do	Improvements in the Arts of Agriculture in the United States. 8vo	New York, 1843.
Do	The American Swine Breeder. 24mo	Boston, 1844.
Embury, Mrs	American Flowers in their Native Haunts	New York,
Emerson, Geo. B	Report on the Trees and Shrubs of Massachusetts. 8vo	Boston, 1846.
Emerson, Gouverneur	The American Farmer's Encyclopædia. 8vo	New York, 1858
Emmons, Ebenezer	The Birds of Massachusetts. 8vo	Amherst, Mass., 1833.
Enfield, Edward	Treatise on Indian Corn. 12mo	New York, 1866.
	An Inquiry into the State of the Farms: to the Farmers of New Hampshire. 8vo	[Boston,] 1812.
Entz, J. F	Exchange and Cotton Trade between England and the United States. 8vo	New York, 1840.
Espy, James P	The Philosophy of Storms. 8vo	Boston, 1841.
Evans, Wm. J	The Sugar Planter's Manual. 8vo	Philadelphia, 1848.
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Fancher, O. H. P	The Arabian Farrier and Horse Breaker. 16mo	Lowell, 1852.
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	The Western Farmer's New and Universal Hand Book. 8vo	Chicago, 1856.
Faulkner	Farmer's Manual of Manures. 12mo	New York, 1843.
Fessenden, T. G	The New American Gardener. 12mo	Boston, 1828.
Do	The Husbandman and Housewife. 12mo	Brattleboro', Vt., 1820.
Do	The Complete Farmer and Rural Economist. 12mo	Boston, 1833.
Field, M	Rural Architecture: Designs for Cottages, &c. 8vo	New York, 1857.
Field, Thos. W	Treatise on Pear Culture. 12mo	New York, 1859.
Fisher, S. J	Observations on the European Vine and Wine-Making. 12mo	Philadelphia, 1834.
Fitch, Asa	The Noxious, Beneficial, and other Insects of New York. 8vo	Albany, 1855.
Flagg, Wilson	Studies in the Field and Forest. 12mo	Boston, 1856.
Do	Mount Auburn; its Scenes, Beauties, and Lessons. 12mo	Boston, 1861.
Flagg, W. J	Three Seasons in European Vineyards. 12mo	New York, 1868.
Flanders, W. A	Easy and Profitable Method of Managing Bees. 12mo.	New York, 1855.
	Flax Culture: Full Directions for Planting and Harvesting this Crop. 8vo	New York, 1868.
Flint, Charles L	Practical Treatise on Grasses and Forage Plants. 8vo.	Boston, 1857.
Do	Treatise on Milch Cows and Dairy Farming. 12mo	Boston, 1858.
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Fostah, E. J	The Agricultural Productions of Louisiana. 12mo	New Orleans, 1845.
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Fox, C	The American Text-Book of Agriculture. 12mo	New York.
French, Henry F	The Principles, Process, and Effects of Draining Land. 12mo	New York, 1859.
Fry, Wm. H	Complete Treatise on Artificial Fish-Breeding. 12mo.	New York, 1854.
Fryatt, H. N	Agriculture; its Essentials and Non-Essentials. 8vo.	New York, 1854.
Fuller, Andrew S	The Illustrated Strawberry Culturist. 12mo	New York, 1864.
Do	Treatise on the Cultivation of the Native Grape. 12mo	New York, 1867.
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Garlick, Theodatus	The Artificial Propagation of Fish. 8vo	Cleveland, Ohio, 1857.
Gaylord & Tucker	Essays on the Improvement of American Husbandry, 2 vols. 18mo	New York.
Genet, Charles E	The Growth and Manufacture of Silk. 8vo	Washington, 1828.
Girard, Charles	Natural History of Fresh-water Fishes. 4to	Washington, 1852.
Giraud, J. P., jr	Sixteen New Specimens of American Birds. folio	New York, 1841.
Do	The Birds of Long Island. 8vo	New York, 1844.
Godman, John D	American Natural History. 2 vols., 8vo	Philadelphia, 1846.
Good, P. R	The Family Flora	New York, 1845.
Goodale, S. L	The Principles of Breeding Domestic Animals. 12mo.	Boston, 1861.
Goodrich, Chauncey	The Northern Fruit Culturist. 12mo	Burlington, Vt., 1850.
Grant, C. W	Manual on the Cultivation of the Vine. 8vo	New York, 1866.

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Do	Beet Sugar, and Cultivation of the Beet Root. 16mo.	Boston, 1867.
Gray, Alonzo	The Elements of Agriculture. 12mo.	New York, 1842.
Gray, Asa (and Torrey)	Flora of North America. 3 vols	New York, 1838–'42.
Gray, Asa	Botany of the United States, including Sullivant's Additions. 8vo.	Cambridge, 1848.
Do.	Botanical Text-Book. Structural and Systematic. 8vo.	New York, 1850.
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Grove, H. D.	An Essay on Sheep. 12mo.	Boston, 1824.
Green & Congdon	Analytical Class-Book of Botany, 8vo.	New York, 1855.
Green, Roland	Treatise on the Culture of Flowers. 18mo.	Boston, 1828.
Gregg, Thomas	Hand-Book of Fruit Culture. 16mo.	New York, 1857.
Gregory, J. J. H.	Squashes: How to grow them. 16mo.	New York, 1867.
Griffin, Wm.	Treatise on the Cultivation of the Pineapple.	Newark, N. J., 1808.
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Hall, Benj. F.	The Land-Owner's Manual. 8vo.	Auburn, 1847.
Hammond, J. H.	Letter to the Jefferson County Agricultural Society, on Marl. 8vo.	Augusta, Ga., 1846.
Haraszthy, A.	Grape Culture, Wines, and Wine-Making. 8vo.	New York, 1862.
Harbison, J. S.	Improved System of cultivating the Honey Bee. 8vo.	Sacramento, 1860.
Harlan, Richard	The Mammiferous Animals of North America. 8vo.	Philadelphia, 1825.
Harris, T. W.	Insects of Massachusetts injurious to Agriculture. 8vo.	Cambridge, 1841.
Do	Insects of New England injurious to Vegetation. 8vo.	Boston, 1852.
Do	The same work enlarged: Edited by C. L. Flint. 8vo.	Boston, 1862.
Harrison, D. A.	The Bee-Keeper's Manual	New York, 1861.
Hartley, R. M.	Essay on Milk, as an article of Human Sustenance. 12mo.	New York, 1842
Hazzi & Mease	Treatise on Rearing Silk-Worms. 8vo.	Washington, 1828
Hedges, Isaac	Treatise on the Culture of Sorghum. 12mo.	Cincinnati, 1863.
Helline, W. C.	The American Farrier. 8vo.	Cleveland, 1852.
	Hemp: Observations on its Culture; with a Plan of the Pennsylvania Hemp Brake. 12mo.	Boston, 1766.
Henderson, Peter	Gardening for Profit. 12mo.	New York, 1867.
Do	Treatise on Practical Horticulture. 12mo.	New York, 1868.
Herbert, Wm. H.	Fish and Fishing in the United States and British Provinces. 8vo.	New York, 1851.
Do	Field Sports of the United States and the British Provinces. 2 vols., 8vo.	New York, 1852.
Do	American Game in its Seasons. 12mo.	New York, 1853.
Do	Horse and Horsemanship of the United States and the British Provinces. 2 vols., 8vo.	New York, 1857.
Do	Hints to Horse-keepers; with Rarey's Method of Training. 12mo.	New York, 1859.
Hind, H. Y.	The Insects and Diseases injurious to Wheat. 8vo.	Toronto, 1857.
Hinds, John	Farriery taught on a New and Easy Plan. 16mo.	Philadelphia, 1830.
	Hints addressed to the Farmers of Essex. 8vo.	Salem, Mass., 1830.
	History of Silk, Cotton, Linen, Wool, and other Fibrous Substances. 8vo.	New York, 1845.
Hitchcock, Edward	Animals and Plants of Massachusetts. 8vo.	Amherst, 1835.
Hoff, A.	The North American Pomologist. 4to.	Philadelphia, 1860.
Holbrook, John E.	Description of the Reptiles of the United States. 4to.	Philadelphia, 1838.
Do.	Ichthyology of South Carolina. Illustrated. 4to.	Charleston, S. C., '55.
Holmes, Francis	The Southern Farmer and Market Gardener. 12mo.	Charleston, 1852.
Hooker, Worthington	Natural History for Schools and Families. 12mo.	New York, 1860.
Hooker, H.	The Farmer's Own Book. 24mo.	New York, 1839.
Hoopes, Josiah	The Book of Evergreens; their Propagation, Cultivation, &c. 12mo.	New York, 1868.
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Do.	The Western Fruit Book; with Plates. 12mo.	Cincinnati, 1857.
Hooper, J. J.	Treatise on the Dog and Gun	New York, 1858.
	The Horse and its Rider	New York.
	The Horse, or Gentleman's New Pocket Farrier	Boston.
	The Horse-Owner's Friend: Diseases and Accidents of the Horse. 24mo.	Ann Arbor, Mich., '67.
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Hunter, A.	Georgical Essays. 6 vols., 8vo.	New York, 1803–4.
Husmann, Geo.	Culture of the Native Grapes and American Wine. 12mo.	New York, 1866.
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Ives, John M	The New England Fruit Book. 18mo	Boston.	
Jaques	Manual of the House: How to build Dwellings, Barns, &c	New York,	1867.
Jaques, George	Practical Treatise on the Management of Fruit Trees. 16mo	Worcester,	1849.
Jaques, D. H	The Barn-Yard: How to breed Domestic Animals, &c	New York,	1867.
Do	The Garden: A New Manual of Practical Horticulture	New York,	1867.
Jennings, Robert	Treatise on Sheep, Swine, and Poultry. 12mo	Philadelphia,	1861.
Do	Horse-Training Made Easy. 12mo	Philadelphia,	1865.
Johnson, Louisa	Every Lady her own Flower-Gardener	New Haven,	1858.
Johnson, S. W	Rural Economy, Roads, Culture of the Vine, &c., 8vo	New Brunswick,	1806.
Johnson, Samuel W	Peat and its Uses as a Fertilizer and Fuel. 12mo	New York,	1866.
Kemps	Landscape Gardening: How to lay out a Garden. 12mo	New York,	1859.
Kenrick, Wm	The New American Orchardist. 12mo	Boston,	1833.
Do	The American Silk-Growers' Guide. 18mo	Boston,	1840.
Kent, J. E	The Farmers' Light-House, or Agricultural Chemistry. 18mo	Philadelphia,	1857.
Kern, G. M	Practical Landscape Gardening. 12mo	Cincinnati,	1855.
Kidder, K. P	Guide to Bee-Culture and Bee-Management. 12mo	Burlington, Vt.	1858.
Kimber, Abby	Familiar Botany; with a Complete Botanical Dictionary. 12mo	Philadelphia,	1854.
Kirr, J. J	On Ornamental and Domestic Poultry	New York.	
Klippart, John H	The Wheat Plant: its Culture, Diseases, &c. 12mo	New York,	1860.
Do	Principles and Practice of Land-Drainage. 12mo	Cincinnati,	1867.
Knowlton, J. C	The Complete Farrier, or Horse-Doctor. 8vo	Philadelphia,	1851.
Do	Kitchen Directory and American Housewife. 12mo	New York.	
Knowlton, J. M	Treatise on our Hardy Grapes		
Langstroth, L. L	Treatise on the Hive and Honey Bee. 12mo	New York,	1859.
Larson, H	Manual for Pruning Fruit Trees. 16mo	Philadelphia,	1859.
Lathrop, Leonard E	Farmers' Library: Essays on Agriculture. 12mo	Windsor, Vt.,	1826.
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List, C	Outlines of Botany. 18mo	Philadelphia,	1840.
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Locke, John	Elementary Treatise on Botany. 12mo	Cambridge,	1820.
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Mac Nevin	Application of Chemistry to Agriculture. 8vo	New York,	1825.
Main, Thomas	Culture of the young Thorn and other Hedge Plants. 8vo	Washington,	1807.
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McMahon, B	The American Gardener's Calendar. 8vo	Philadelphia,	1824.
McMullen, Thos	Hand-Book of Wines: How to make them. 12mo	New York,	1852.
Mease, James	A Geological Account of the United States. 18mo	Philadelphia,	1807.
Mead, Peter B	The Culture of the Grape, and Wine-Making. 8vo	New York,	1867.
Meehan, Thomas	The American Hand-Book of Ornamental Trees for Villas and Lawns. 18mo	Philadelphia,	1853.
Meeker, N. C	Life in the West. 12mo	New York,	1868.
Michaux, F. A	The Oaks of North America; with Appendix by Wade. 8vo	Dublin,	1809.
Do	North American Sylva; with Notes by J. J. Smith. 3 vols., 8vo	Philadelphia,	1857.
Miner, T. B	The American Bee-Keeper's Manual. 12mo	New York,	1857.
Do	The Domestic Poultry-Book. 12mo	New York.	
Milburn, M. M	The Cow: Dairy-Husbandry, and Cattle-Breeding. 12mo	New York,	1852.
Mitchell, D. G	My Farm at Edgewood. 12mo	New York,	1863.
Do	Wet Days at Edgewood. 12mo	New York,	1864.
Do	Rural Studies; with Hints for Country Places. 12mo	New York,	1867.
Mohr, Frederick	Treatise on the Grape-Vine; translated from the German, with Notes by Charles Siedhof. 12mo	New York,	1867.
Moore, Thomas	The Great Error of American Agriculture Exposed. 8vo	Baltimore,	1801.
Morfit, C	Treatise on Manures. 12mo	Philadelphia.	
Morrell, L. A	The American Shepherd; History of Sheep-Breeding, &c., 12mo	New York,	1845.
Morris, Edmund	Ten Acres Enough; showing how a Small Farm will keep a Large Family. 12mo	New York,	1864.
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Do	Farming for Boys. Illustrated. 16mo	Boston,	1868.
Muench, F	School for American Grape Culture. 12mo	St. Louis,	1864.
Muhlenburg, Henry	Catalogue of the Native and Naturalized Plants of North America. 8vo	Lancaster, Pa.,	1813.
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Munson, Laura G	Flowers from My Garden. 4to	New York,	1863.
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Nash, J. F	Scientific Treatise on Agricultural Chemistry. 12mo	New York,	1853.
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Neill, Patrick	Fruit, Flower, and Kitchen Garden. 12mo	New York,	1857.
Nettle, Richard	The Salmon Fisheries of the St. Lawrence, &c. 12mo	Montreal,	1857.
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Nolan, Lewis E	On Training Cavalry Horses; with a Chapter on Rarey's Method. 12mo	New York,	1862
Norris, Thaddeus	The American Angler's Book. 8vo	Philadelphia,	1864
Do	Details of Artificial Fish Breeding. 8vo	Philadelphia,	1868.
Norton, John P	Elements of Scientific Agriculture. 12mo	New York,	1851.
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Do	The New England Cultivator	Boston,	1852.
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Do	Treatise on the Vine and Management of Vineyards. 8vo	New York,	1830.
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Do	Manual on the Mulberry Tree. 12mo	Philadelphia.	1839.
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Rafinesque, F	Medical Flora: The Medical Botany of the United States. 2 vols., 12mo	Philadelphia,	1828.
Do	Flora of the State of Louisiana. 8vo	New York.	1817.
Rand, Edward S., jr	Flowers for the Parlor and Garden. 12mo	Boston.	1863.
Do	Garden Flowers: How to Cultivate Them. 12mo	Boston.	1866.
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Do	Fine Wool Sheep Husbandry. 8vo	New York.	1859.
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Roberts, Job	The Pennsylvania Farmer. 12mo	Philadelphia.	1804.
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Salisbury, J. H	An Analysis of the Apple. 8vo	Albany.	1850.
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Smeaton, A. C	The Builder's Pocket Companion. 16mo	Philadelphia, 1850.
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Smith, Charles H	Landscape Gardening; with additions by L. F. Allen.	New York, 1867.
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Stansbury	Chinese Sugar-Cane, Sugar-Making, &c	New York, 1857.
Starr, W. H	The Cranberry Culturist. 12mo	New London, 1860.
Stephens, Henry	The Book of the Farm; with notes by J. S. Skinner. 2 vols., 8vo	New York, 1846.
Stewart, F. L	A Treatise on Sorghum and its Products. 12mo	Philadelphia, 1867.
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Sutherland, J. W	A New Method of Training Horses. 16mo	Harvard, Ill., 1867.
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Swane, Samuel	Original Designs for Cottages, Villas. 2 vols	Philadelphia, 1854.
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Swanwick, John	A Plan for Increasing the Value of Farms in Middle and Western Pennsylvania. 8vo	[Philadelphia,] 1800.
Tate, Benjamin	The American Farm Book	Philadelphia.
Taylor, John	The General Character of the Dog. 16mo	Philadelphia, 1807.
Taylor, John	Arator: a Series of Agricultural Essays. 16mo	Petersburg, Va., 1818.
Taylor J. O	The Farmer's School Book	Ithaca N. Y., 1834.
Tegetmeier	The Book of Poultry	New York, 1867.
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Thorburn, Grant	Gentleman's and Gardener's Calendar. 12mo	New York, 1821.
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Thorpe, T. B	The Hive of the Bee Hunter. 12mo	New York, 1854.
Thornton, P	The Southern Gardener and Receipt Book. 12mo	Camden, S. C. 1840.
Thurber, George	(Editor of) Practical Details on the Culture, Curing, and Marketing of Hops. 8vo	New York, 1865.
Tinelli Lewis	Treatise on the Mulberry and Silk Culture. 12mo	New York, 1837.
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Do	The American Wheat Culturist. 12mo	New York, 1868.
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Wood, J. G	Homes without Hands: a Description of the Habitations of Animals	New York, 1866.
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COLMAN'S RURAL WORLD AND VALLEY FARMER, St. Louis, Mo. Weekly, $2 per annum. Norman J. Colman, editor and proprietor. William Muir and C. W. Murtfeldt, associate editors.

COUNTRYMAN, (THE,) Cincinnati, O. Monthly, $1 50 per annum. Charles S. Burnett, publisher.

CULTIVATOR AND COUNTRY GENTLEMAN, Albany, New York. Weekly, $2 50 per annum. Luther Tucker & Son, publishers and proprietors. Luther Tucker, Luther H. Tucker, and John J. Thomas, editors.

DIETZ'S EXPERIMENTAL FARM JOURNAL, Chambersburg, Pa. Monthly, $1 50 per annum. G. A. Deitz, editor and publisher.

DIXIE FARMER, Columbia, Tenn. Weekly, $3 per annum. Paul, Taval & Hanner, publishers. Hunter Nicholson, editor.

FARM AND GARDEN, Clinton, S. C. Monthly, $1 per annum. Wm. P. Jacobs, editor. James R. Jacobs & Co., publishers.

FARMER'S GAZETTE AND INDUSTRIAL INDEX, Richmond, Va. Monthly, $1 per annum. S. Bassett French, editor and proprietor.

FARMER'S HOME JOURNAL, Lexington, Ky. Weekly, $3 per annum. James J. Miller, editor and proprietor.

FARMER'S UNION, Minneapolis, Minn. Monthly, 50 cents per annum. W. A. Nimochs, publisher. John H. Stevens, editor.

FARM JOURNAL, Chambersburg, Pa. Monthly, 25 cents per annum. H. S. Gilbert & Co., publishers.

GARDENER'S MONTHLY, Philadelphia, Pa. Monthly, $2 per annum. Brinckloe & Marot, publishers. Thomas Meehan, editor.

GERMANTOWN TELEGRAPH, Philadelphia, Pa. Weekly, $2 per annum. Philip R. Freas, editor and proprietor.

GRAPE CULTURIST, St. Louis, Mo. Monthly, $2 per annum. George Husmann, proprietor.

HEARTH AND HOME, New York City. Weekly, $4 per annum. Pettingill, Bates & Co., publishers. Donald G. Mitchell and Harriet Beecher Stowe, editors. Joseph B. Lyman and Mary E. Dodge, associate editors.

HOME, FARM, AND ORCHARD, Newburg, N. Y. Weekly, $1 per annum. A. A. Bensel & Son, editors and publishers.

HORTICULTURIST AND FARMER, De Soto, Mo. Semi-monthly, $1 50 per annum. Gardner & Co., publishers. O. A. A. Gardner, editor.

HORTICULTURIST. (THE,) New York City. Monthly, $2 50 per annum. F. W. Woodward, publisher. Henry T. Williams, editor and proprietor.

IOWA HOMESTEAD AND WESTERN FARM JOURNAL. Des Moines, Iowa. Weekly, $2 per annum. Wm. Duane Wilson, editor and publisher.

JOURNAL OF AGRICULTURE, St. Louis, Mo. Weekly, 2 per annum. L. D. Morse & Co., publishers and proprietors. L. D. Morse, editor.

JOURNAL OF THE FARM, Philadelphia, Pa. Monthly, 50 cents per annum. Baugh & Sons, publishers.

KANSAS FARMER, Leavenworth, Kansas. Semi-monthly, $1 per annum. G. T. Anthony, editor and publisher.

MAINE FARMER, Augusta, Me. Weekly, $2 per annum. S. L. Boardman, editor.

MARYLAND FARMER, Baltimore, Md. Monthly, $1 50 per annum. S. Sands Mills & Co., publishers and proprietors.

MASSACHUSETTS PLOUGHMAN, Boston, Mass. Weekly, $2 50 per annum. George Noyes, publisher and proprietor.

MINNESOTA MONTHLY, St. Paul, Minn. $2 per annum. D. A. Robertson, editor and proprietor.

MIRROR AND FARMER, Manchester, N. H. Weekly, $1 50 per annum. John B. Clarke, editor and proprietor.

MICHIGAN FARMER AND STATE JOURNAL OF AGRICULTURE, Detroit, Mich. Weekly, $2 per annum. Johnstone & Gibbons, publishers. B. F. Johnstone, editor.

MODEL FARMER, Corinth, Miss. Semi-monthly, $2 per annum. Key & Bare, publishers. Thomas J. King, editor.

MOORE'S RURAL NEW YORKER, New York City and Rochester, N. Y. Weekly, $3 per annum. D. D. T. Moore, editor and proprietor. Chas. D. Bragdon, G. F. Wilcox, and A. A. Hopkins, associate editors. Henry S. Randall, editor of department of sheep husbandry; A. Willard, editor of department of dairy husbandry; and Daniel Lee, southern corresponding editor.

NATIONAL AGRICULTURIST AND PENNSYLVANIA FARM JOURNAL, Pittsburgh, Pa. Monthly, $1 per annum. James M. Kuester, editor and publisher.

NEW ENGLAND FARMER, Boston, Mass. Monthly, $1 50 per annum. R. P. Eaton & Co., publishers. Simon Brown and S. Fletcher, editors.

NEW ENGLAND FARMER, Boston, Mass. Weekly, $2 50 per annum. R. P. Eaton & Co., publishers. Simon Brown, agricultural editor. S. Fletcher, assistant editor. R. P. Eaton, general editor.

NEW ENGLAND HOMESTEAD, Springfield and Northampton, Mass. Monthly, 75 cents per annum. Henry M. Burt & Co., editors and publishers.

NEW ENGLAND HOMESTEAD, Springfield and Northampton, Mass. Weekly, $2 50 per annum. Henry M. Burt & Co., editors and publishers.

NORTHERN FARMER, Fond du Lac, Wis. Monthly, $1 25 per annum. Fred. D. Carson, publisher and proprietor.

NORTHWESTERN FARMER, Indianapolis, Ind., and Chicago, Ill. Monthly, $1 50 per annum. Northwestern Farmer Co., publishers.

OHIO FARMER, Cleveland, O. Weekly, $2 per annum. S. C. Harris and G. E. Blakeslee, editors. Mrs. Helen L. Bostwick, corresponding editor.

OUR FRIEND AND COMPANION, Goodhue, Minn. Monthly, 50 cents per annum. Harrison Lowater, publisher.

PRACTICAL FARMER AND RURAL ADVERTISER, Philadelphia, Pa. Monthly, $1 per annum. Paschall Morris, editor and proprietor. Horatio Crane, assistant editor.

PRAIRIE FARMER, Chicago, Ill. Weekly, $2 per annum. Prairie Farmer Co., publishers. Henry D. Emery, W. W. Corbett, H. T. Thomas, and Rodney Welch, editors.

RECONSTRUCTED FARMER, Tarboro', N. C. Monthly, $2 per annum. Thigpen & Dancy, editors and proprietors.

RECORD AND FARMER, Brattleboro', Vt. Weekly, $2 50 per annum. E. P. & A. C. Ackerman, editors and publishers.

RURAL AMERICAN, New York City; (Post Office address: New Brunswick, N. J.) Monthly, $1 50 per annum. T. B. Miner, editor and proprietor.

RURAL BUCKEYE, Chillicothe, O. Semi-monthly, $1 50 per annum. The Rural Printing Co., publishers. Samuel L. Leffingwell, editor.

RURAL GENTLEMAN, Baltimore, Md. Monthly, $1 per annum. J. B. Robinson & Co., publishers. Frank L. Morling, editor.

RURAL HOME, Buffalo, N. Y. Monthly, 50 cents per annum.

RURALIST, Cincinnati, Ohio. Monthly, $1 per annum. J. S. Sheppard, publisher.

RURAL SOUTHERNER, Atlanta, Ga. Monthly, $1 per annum. Miller & Bailey, publishers. Samuel A. Echols, editor.

RURAL WEST AND WEEKLY JOURNAL, Quincy, Ill. T. M. Rogers, editor and publisher.

SMALL FRUIT RECORDER AND COTTAGE GARDENER, Palmyra, N. Y. Monthly. Purdy & Johnston, editors.

SORGO JOURNAL AND FARM MACHINIST, Cincinnati, O. Monthly, 50 cents per annum. Blymyer, Norton & Co., publishers and proprietors. William Clough, editor.

SOUTHERN CULTIVATOR, Athens, Ga. Monthly, $2 per annum. Wm. & W. L. Jones, editors and proprietors. D. Redmond, Arcola, La., corresponding editor.

SOUTHERN HORTICULTURIST AND MONTHLY JOURNAL, Yazoo City, Miss. Monthly, $2 per annum. H. A. Swasey, editor and proprietor.

SOUTHERN FARMER, Memphis, Tenn. Monthly, $2 per annum. W. Phillips & Co., proprietors. Dr. M. W. Phillips, editor; assisted by Prof. E. W. Hilgard, P. J. Berkmans, Geo. W. Gift, Geo. Husmann, C. C. Langdon, J. Van Buren, and D. L. Adair.

SOUTHERN PLANTER AND FARMER, Richmond, Va. Monthly, $2 per

annum. Charles B. Williams, editor and proprietor. Frank G. Ruffin, associate editor. John M. Allen, horticultural editor.

SOUTHERN RURALIST, Tangipahoa, La. Monthly, $1 50 per annum.

TEXAS FARMER, Henderson, Texas. Monthly, $2 per annum. W. R. Marshall and J. M. Dodson, editors and proprietors.

TEXAS PLOW BOY, Lockhart, Texas.—Weekly and semi-monthly; weekly, $3; semi-monthly, $2 50, per annum. N. C. Raymond and E. H. Rogan, editors and proprietors.

TILTON'S JOURNAL OF HORTICULTURE, AND FLORAL MAGAZINE, Boston, Mass. Monthly, $3 per annum. Tilton & Co., Boston, and Hovey & Heffron, Chicago, publishers.

TURF, FIELD, AND FARM, New York City. Weekly, $5 per annum. S. D. Bruce & J. C. Simpson, editors and proprietors.

WESTERN RURAL, Chicago, Ill., and Detroit, Mich. Weekly, $2 per annum. H. N. F. Lewis, editor and proprietor. G. E. Morrow and Thomas H. Glenn, Chicago, and Edward Mason, Detroit, associate editors.

WHITLOCK EXPOSITION RECORDER, New York City. Monthly, $1 50 per annum. The Whitlock Exposition Publication and Exchange Co., publishers. Andrew S. Fuller, editor.

WILLAMETTE FARMER, Salem, Oregon. Weekly, $2 50 per annum. A. L. Stinson, publisher and proprietor. John Minto, editor.

WESTERN FARMER, Madison, Wis., and Chicago, Ill. Weekly, $2 per annum. W. B. Davis, editor and publisher.

WESTERN STOCK JOURNAL, Sigourney, Iowa. Monthly, $1 per annum. J. H. Sanders & Co., publishers.

WORKING FARMER, New York City. Monthly, $1 50 per annum. William L. Allison & Co., publishers and proprietors. William L. Allison, editor.

METEOROLOGY OF 1868.

[Compiled from monthly reports made to the Smithsonian Institution through this Department. The observations were made daily, at the hours of 7 a. m. and 2 and 9 p. m., with slight occasional exceptions.]

Stations in States and Territories.	JANUARY.						FEBRUARY.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
MAINE.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Steuben	24	38	19	— 8	15.8	4.93	21	45	12	—13	16.9	3.70
Williamsburg	23	30	11	—14	10.6	2.05	20	36	11	—16	10.2	2.00
West Waterville	2, 24	38	19	—11	16.1	2.27	9, 20	38	8, 12, 25	—12	14.8	1.85
Gardiner	24	40	19, 31	— 3	17.6	2.86	20	44	12	—12	16.9	1.87
Standish	2	38	13, 14	— 9	14.9	2.98	21	47	8	—18	13.8	1.73
Norway	2, 8	38	11	—18	14.9	2.00	20	44	12	—22	12.9	1.30
Cornish	2	38	12	— 4	16.6	4.10	21	42	8	—11	15.3	1.10
Cornishville	2	35	12	0	17.8	4.13	21	41	23	—10	16.6	3.00
Averages	......	......	......	......	15.5	3.17	......	......	......	......	14.8	2.07
NEW HAMPSHIRE.												
Portsmouth	......	......	......	......	......	......	21	50	8	— 7	21.0	2.78
Stratford	23	32	13	—15	12.7	2.30	20	36	8	—24	9.3	2.00
Shelburne	13	38	12	— 6	......	2.50	20	46	26	—22	9.4	0.84
North Barnstead	24	44	13	3	21.1	2.95	24	46	3	— 4	18.3	1.23
Concord	......	......	......	......	......	......	20	45	12	—15	17.9	......
Claremont	2, 3	39	13	— 9	18.0	2.65	20	45	24	—13	15.0	0.50
Averages	......	......	......	......	17.3	2.60	......	......	......	......	15.2	1.47
VERMONT.												
Lunenburg	2	33	13	—16	12.7	1.88	29	37	24	—27	8.9	1.45
North Craftsbury	3	37	14	— 3	17.1	2.14	29	42	3, 12	—12	14.4	1.60
Randolph	3	36	7	—20	15.1	2.52	20	41	8	—31	10.2	0.55
Near St. Albans	23	37	28	—18	11.7	0.25	29	38	23	—27	8.1	......
Middlebury	2	37	6	—21	13.4	1.71	20	36	8	—27	11.4	1.15
Averages	......	......	......	......	14.0	1.70	......	......	......	......	10.6	1.19
MASSACHUSETTS.												
Kingston	3, 7, 23	42	10, 13	7	26.0	4.45	21	52	8	— 2	24.8	1.70
Topsfield	2, 3	39	17	4	20.1	3.46	21	48	8	— 7	17.9	1.23
Lawrence	3	41	17	3	21.6	3.66	21	48	3	— 5	19.8	1.46
Georgetown	3	44	17	5	22.8	2.41	21	49	8	— 8	19.5	1.12
Newbury	3	40	12, 13, 17	4	21.7	......	21	49	8	— 5	20.4	0.60
Milton	3	45	13, 17	4	22.0	2.91	21	55	8	—13	21.6	1.96
Brookline	25	45	6	— 2	23.6	......	21	50	8	—10	23.6	......
North Billerica	3	42	19	— 1	21.0	......	21	51	8	—22	19.6	......
West Newton	25	44	18	1	21.9	3.05	21	55	8	—20	18.8	1.50
New Bedford	23	43	10, 13	8	25.4	5.91	21	52	8	— 1	23.7	2.32
Worcester	23	39	13	4	21.4	3.27	21	48	23	— 4	19.2	1.53
Mendon	23	39	13	0	19.6	......	21	48	3, 23	— 6	17.5	......
Lunenburg	8	43	12, 13	— 2	20.3	3.18	21	49	23	— 8	18.9	1.45
Amherst	3	40	13, 17	0	20.2	3.52	21	45	8	—12	18.2	1.93
Richmond	24	37	6, 10	— 2	19.1	5.05	20	41	23	—10	17.4	4.50
Williams College	23	39	28	—10	19.3	2.42	19, 20	40	8	—19	16.1	1.95
Averages	......	......	......	......	21.6	3.56	......	......	......	......	18.8	1.72

Meteorology of 1868—Continued.

Stations in States and Territories.	January. Date.	January. Maximum temperature.	January. Date.	January. Minimum temperature.	January. Mean temperature.	January. Rain and melted snow.	February. Date.	February. Maximum temperature.	February. Date.	February. Minimum temperature.	February. Mean temperature.	February. Rain and melted snow.
RHODE ISLAND.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Newport	2, 3, 23	42	10	10	27.4	5.48	21	56	23	4	26.1	4.25
CONNECTICUT.												
Pomfret	23	39	10	1	20.7	2.02	21	45	23	— 6	18.5	1.80
Groton	3	52	10, 17	4	23.6	2.90	21	52	8	— 6	22.1	3.10
Columbia	3	50	17	0	24.5	3.10	21	48	8, 23	— 4	21.7	2.23
Middletown	3	42	17	0	22.7	3.36	21	63	8	— 9	20.8	1.53
Colebrook	7	38	10	— 7	17.4	......	20, 21	42	23	—12	16.8	......
Averages	....	......	....	......	21.8	2.85	....	......	....	......	20.0	2.16
NEW YORK.												
Moriches	3	50	31	— 8	28.4	4.34	21	55	8	—15	26.0	2.54
South Hartford	3	42	6	—14	16.5	5.60	20	44	23	—25	15.5	1.45
Troy	3	39	7, 28	— 3	19.5	3.33	20	42	8	—16	17.0	0.86
Germantown	3	42	31	0	19.5	3.10	19, 20	44	12	—14	18.0	1.30
Garrison's	3	43	10	6	23.0	3.41	20	47	12	—10	19.0	1.55
Throg's Neck	2	42	10	6	25.3	......	21	53	23	— 2	22.3	......
White Plains	2	46	10	6	25.4	......	20	47	3	— 1	22.2	......
Deaf & Dumb Inst.	23	41	10	6	25.8	4.00	21	50	23	1	23.0	2.31
Columbia College.	23	43	10	14	28.4	2.22	21	51	23	6	25.8	1.02
Flat Bush	23	41	10	7	25.1	3.41	21	51	8	0	26.3	0.57
Stapleton	3	45	10	7	27.5	3.45	21	51	3, 4, 23	7	25.8	2.60
Newburg	4	48	10	3	23.0	3.27	19, 20	48	8	—18	19.5	......
Minaville	23	32	7	— 7	12.2	3.14	20	36	23	—16	10.0	0.97
Gouverneur	23	42	28	—22	12.7	2.00	20	43	3	—28	12.4	1.54
North Hammond	23	41	28	—12	14.6	1.58	20	44	11	—21	14.3	1.39
Houseville	23	40	12, 27	— 7	15.9	2.57	20	43	3	—20	13.4	1.61
South Trenton	23	40	28	— 6	16.0	3.30	20	48	3, 23	—14	12.3	2.60
Cazenovia	23	40	5	— 2	18.6	4.45	20	42	23	—17	15.7	3.18
Oneida	23	44	6	— 4	21.9	4.30	20	48	3	—14	18.6	2.50
Depauville	23	38	28	—12	15.9	3.35	20	40	3	—18	15.8	3.51
Theresa	23	39	29	—31	......	2.66	9	34	11	—26	......	1.95
Oswego	3	39	28	— 8	20.6	5.49	20	44	11	— 8	18.8	2.25
Palermo	23	39	28	—23	16.2	4.50	20	39	11	—19	14.9	2.90
Nichols	4, 23	44	30	— 2	21.7	......	20	58	8	—20	18.0	......
Newark Valley	....	......	....	......	......	......	20	46	7	—32	......	......
Geneva	23	42	28	0	20.9	1.92	20	42	23	— 5	19.8	1.69
Rochester	20	41	28	0	20.8	1.45	20	45	11	— 2	20.7	1.59
Little Genesee	23	42	28	—12	19.4	2.00	20	52	8	—19	17.4	1.83
Buffalo	23	37	28	1	20.9	2.23	20	41	3, 11	— 1	20.9	2.83
Averages	....	......	....	......	20.6	3.22	....	......	....	......	18.6	1.91
NEW JERSEY.												
Paterson	4	43	10	3	25.3	1.95	21	51	8	— 6	21.4	1.38
Newark	3	43	10	6	25.9	3.28	21	51	4	— 4	21.9	1.92
New Brunswick	23	44	31	6	25.1	2.18	21	46	8	—10	20.4	1.54
Trenton	2, 3, 4, 24	42	31	10	30.2	4.30	21	50	8	— 4	26.8	2.20
Burlington	3	48	31	8	30.2	3.20	20	52	8	— 5	26.5	2.10
Moorestown	23	46	31	5	26.7	3.77	20	53	8	— 5	23.0	2.44
Mount Holly	23	47	31	6	27.9	......	20	52	8	— 2	24.8	......
Dover	4	42	10	4	25.2	6.00	21	49	12	— 7	20.7	1.45
Haddonfield	23	45	31	8	27.9	3.32	20	50	8	— 3	24.1	2.25
Newfield	4	51	31	1	30.9	......	20, 21	53	8	— 7	26.1	......
Greenwich	4	46	31	10	29.5	3.57	21	50	8	3	26.6	1.86
Vineland	4	46	31	3	26.6	4.42	21	52	8	— 6	24.3	4.06
Averages	....	......	....	......	27.6	3.60	....	......	....	......	23.9	2.09
PENNSYLVANIA.												
Nyces	3	50	30	— 8	20.6	2.68	19	49	8	—20	18.0	1.23
Fallsington	2	44	30	4	27.0	3.50	20	55	8	— 6	23.7	2.30
Philadelphia	4	45	9, 31	13	30.3	3.49	20	51	23	4	26.6	2.52

Meteorology of 1868—Continued.

Stations in States and Territories.	January.						February.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
PENNA.—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Germantown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19	[illegible]	[illegible]	— [illegible]	[illegible]	2.00
[illegible]	[illegible]	[illegible]	31	[illegible]	[illegible]	[illegible]	[illegible]	53	[illegible]	— [illegible]	[illegible]	1.[illegible]
[illegible]	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	— [illegible]	[illegible]	1.46
[illegible]	[illegible]	[illegible]	[illegible]	— [illegible]	[illegible]	3.13	[illegible]	[illegible]	[illegible]	— [illegible]	[illegible]	1.60
[illegible]	......	......	......	......	......	......	19	47	2	— [illegible]	[illegible]	......
[illegible]	[illegible]	[illegible]	10, 19	4	[illegible]	1.75	[illegible]	[illegible]	4	— [illegible]	[illegible]	1.55
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	53	[illegible]	— 1	[illegible]	......
[illegible]	[illegible]	[illegible]	31	— 2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—1[illegible]	[illegible]	2.11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	52	[illegible]	— [illegible]	[illegible]	2.10
Silver Spring ..	[illegible]	42	16	[illegible]	[illegible]	......	[illegible]	4[illegible]	[illegible]	— [illegible]	[illegible]	......
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.15	20	53	[illegible]	— 2	25.6	1.95
[illegible]	[illegible]	[illegible]	31	[illegible]	[illegible]	[illegible]	21	49	4	2	23.5	1.76
[illegible]	......	......	......	......	......	......	20	55	[illegible]	—22	20.0	1.02
[illegible]	4	4[illegible]	10, 31	2	21.3	2.56	19	48	[illegible]	—1[illegible]	18.0	1.57
[illegible]	3	50	[illegible]	3	24.3	4.02	20, 21	53	[illegible]	—15	21.1	1.77
Marysville	23	44	19	— 3	24.0	2.[illegible]	20	52	3	—10	24.0	2.60
Grampian Hills ..	3, 23	[illegible]	9	— [illegible]	19.[illegible]	3.3[illegible]	20	50	8	—16	16.6	3.80
Johnstown	......	......	......	......	......	......	19, 20, 21	46	1	—14	21.8	4.55
Franklin	23	42	[illegible] 19	— 1	[illegible]	......	20	50	3	—24	18.[illegible]	......
[illegible]	3, 23	47	13	— 3	[illegible]	......	20	56	3	—12	24.4	......
New Castle	23	43	9	4	24.3	......	19, 20	50	3	—10	25.2	......
[illegible]	[illegible]	45	6	8	27.0	......	[illegible]	50	3	0	27.4	2.75
[illegible]	5	49	19	— 9	[illegible]	2.[illegible]	20	57	3	— 7	26.5	1.03
Averages	......	......	......	......	25.[illegible]	2.7[illegible]	......	......	......	......	22.3	2.02
MARYLAND.												
Woodlawn	4	56	10	8	27.0	4.07	20	52	8	— 1	24.4	2.67
Catonsville	4	46	8, 12, 13	10	25.7	......	20	50	23	6	24.8	......
Annapolis	2, 4	54	31	— 5	35.9	4.17	19	56	8	— 1	31.3	2.31
St. Inigoes	4, 24, 27	58	31	10	31.3	4.55	20	60	26	13	31.0	2.60
Emmittsburg	1	50	9	8	27.3	2.72	20	52	8	— 8	24.6	......
Mt. St. Mary's Col.	3	41	9	6	26.3	......	19, 20	49	8	2	23.9	1.61
Averages	......	......	......	......	28.9	3.[illegible]	......	......	......	......	26.7	2.35
VIRGINIA.												
Surry Court House	4	64	31	13	36.0	......	20	69	12	11	36.5	......
[illegible]	4	59	18	19	33.3	11.10	19	55	12	22	40.1	......
[illegible]	16, 25	68	31	— 4	......	1.17	20	58	1, 8	3	......	0.20
[illegible]	4	60	31	3	32.5	......	19	60	8	4	33.8	......
Lynchburg	7	58	30	16	35.4	......	19	57	2, 7, 8	20	36.0	......
[illegible]	3	52	31	— 8	[illegible]	1.68	21	58	1	— 8	30.0	7.75
Wytheville	......	......	......	......	......	......	20	56	1	— 8	31.2	1.75
Averages	......	......	......	......	[illegible]	4.65	......	......	......	......	34.6	3.26
WEST VIRGINIA.												
Romney	[illegible]	[illegible]	13, 31	10	31.0	......	19	62	8	6	31.3	......
[illegible]	1	65	12, [illegible]	8	33.5	2.00	19, 20	60	1	— 2	32.8	4.63
Weston	4	60	12, 13	4	[illegible]	......	......	......	......	......	......	......
[illegible] Springs	3	67	30	— 4	32.2	......	16, 19	73	1	— 2	32.9	......
[illegible] Court House	4, 23	58	30	10	33.2	4.90	24	60	1	9	36.7	0.60
Averages	......	......	......	......	31.8	3.45	......	......	......	......	33.4	2.61
NORTH CAROLINA.												
Kenansville	......	......	......	......	......	......	21	65	......	......	......	......
[illegible]	4	70	18	17	40.2	3.29	20	69	8	[illegible]	40.6	2.25
Raleigh	4	62	18	12	35.9	4.20	20	66	8	15	35.3	3.00
[illegible]	4	58	31	12	35.0	1.40	20	60	8	17	35.7	3.20
Albemarle	5	63	18, 31	8	36.1	6.[illegible]	20	69	8	12	37.1	3.95

Meteorology of 1868—Continued.

Stations in States and Territories.	JANUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	FEBRUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
NORTH CAROLINA—Continued.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Statesville	[illegible]	52	18	8	31.4	6.50	17	52	13	[illegible]	[illegible]	3.[illegible]5
[illegible]	3	61	31	3	33.5	.....	20	62	1	4	[illegible]	.....
Averages	.....	.....	.....	.....	[illegible]	4.82	.....	.....	.....	.....	36.3	3.23
SOUTH CAROLINA.												
Aiken	3	75	31	22	34.5	2.00	17	65	7	25	34.6	3.34
Gowdysville	5	65	31	12	38.0	.....	20	64	1	19	38.0	.....
Averages	.....	.....	.....	.....	36.3	2.00	.....	.....	.....	.....	36.8	3.34
GEORGIA.												
Atlanta	3, 7	72	30	6	37.0	4.01	22	68	7	17	40.8	3.55
Macon	7	76	30	15	44.6	7.86	19	68	1	26	47.4	6.89
Penfield	.....	.....	30	16	.....	.....	20	67	7	24	44.9	.....
Averages	.....	.....	.....	.....	40.8	5.94	.....	.....	.....	.....	44.4	5.22
ALABAMA.												
Opelika	3, 4, 7	78	30	12	44.2	.....	17	68	7	25	47.6	.....
Carlowville	7	78	30	14	45.1	8.18	9	72	1	30	49.2	6.79
Moulton	3	70	30	14	38.2	5.65	9, 21	62	7	22	44.7	2.26
Fish River	7	83	30, 31	21	.....	.....	19, 23	72	1	27	.....	4.60
Greene Springs	3, 7	79	30	12	42.9	11.04	22	72	1	22	48.4	3.03
Havana	3	79	30, 31	17	43.1	11.23	17, 22	70	1	22	47.4	2.79
Averages	.....	.....	.....	.....	42.7	9.02	.....	.....	.....	.....	47.5	3.89
FLORIDA.												
Jacksonville	7	81	31	29	57.6	2.80	10, 21	78	7	36	54.0	2.25
Port Orange	4	84	30	31	58.1	.....	10	84	29	40	56.8	.....
Gordon	.....	.....	.....	.....	.....	.....	3, 4, 6, 7	78	31	27	59.6	.....
Lake City	3, 4	74	31	26	53.2	.....	9	73	1, 7, 29	35	53.7	2.25
Averages	.....	.....	.....	.....	56.3	2.80	.....	.....	.....	.....	56.0	2.25
TEXAS.												
Gilmer	2	86	30	10	41.2	.....	19, 21	80	12	16	49.5	.....
Houston	5	84	30	19	52.0	.....	19, 25	82	12	31	55.6	.....
Columbia	5, 6	84	30	16	52.0	1.38	24	85	12	27	55.2	1.87
Waco	2	89	30	15	42.4	0.70	19	76	11, 12	22	47.6	2.20
Austin	2	87	30	15	46.2	0.36	20	83	12	26	54.6	3.48
Averages	.....	.....	.....	.....	46.8	0.81	.....	.....	.....	.....	52.5	2.52
LOUISIANA.												
New Orleans	7	81	30	25	.....	.....	.....	.....	.....	.....	.....	.....
Benton	2	75	30	15	41.0	.....	19	78	1	21	45.7	.....
MISSISSIPPI.												
Grenada	3, 4, 6	74	30	15	42.7	.....	22	76	12	20	49.9	.....
Natchez	3	75	30	18	46.6	8.16	9, 24	74	1, 12	25	45.7	3.38
Averages	.....	.....	.....	.....	44.7	8.16	.....	.....	.....	.....	47.8	3.38
ARKANSAS.												
Helena	3	74	29, 30	12	35.7	.....	22	76	12	15	45.6	.....

Meteorology of 1868—Continued.

Stations in States and Territories.	JANUARY.						FEBRUARY.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
TENNESSEE.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Elizabethton	7	56	31	5	33.1	......	20	60	1	9	36.8	......
Tusculum College	7	57	30	— 4	31.5	......	20	61	1	3	36.0	......
Lookout Mountain	......	......	......	......	......	......	21, 22	63	7	14	41.2	......
Austin	6	68	30	8	33.5	4.50	23	70	7	18	42.1	0.30
Nashville	4	65	30	14	......	......	21	66	7	20	41.7	......
Clarksville	3	66	9, 29, 30	11	30.9	5.03	23	67	1, 2, 10	19	39.9	1.31
Memphis	3	68	30	13	33.0	5.30	23	72	11	18	43.0	1.28
Averages	......	......	......	......	34.0	4.94	......	......	......	......	40.1	0.96
KENTUCKY.												
Pine Grove	3, 4, 5	54	30	— 2	27.9	4.65	19	59	7	4	33.5	2.05
Lexington	3	57	30	0	28.5	4.81	20	60	7	8	34.2	1.96
Danville	4, 5	60	30	1	32.6	3.95	19	71	7	5	39.3	1.59
Louisville	4, 5	55	30	4	29.6	4.29	19	57	7	6	35.0	1.60
Averages	......	......	......	......	29.7	4.40	......	......	......	......	35.5	1.80
OHIO.												
New Lisbon	4	50	19	— 3	24.2	2.56	20	50	3	—14	23.1	1.55
Steubenville	4	45	12	4	26.0	......	19, 20	46	3	0	28.0	......
Painesville	23	40	9, 10	2	20.6	3.43	20	48	3	3	22.5	1.56
Milnersville	4	50	9, 13	— 6	23.2	9.23	20	52	3	— 8	23.6	1.12
Cleveland	23	44	27, 28	— 4	21.5	1.46	20	48	3	— 3	23.2	1.47
Wooster	4	50	22	— 6	22.9	......	20	52	3	—12	25.2	......
Gallipolis	4	50	30	4	29.4	4.42	20	55	1	7	33.1	1.18
Kelley's Island	20, 23	39	30	0	21.7	1.00	20	48	3	— 5	23.9	0.83
Sandusky	23	42	9, 30	2	19.5	0.93	20	50	3	—12	23.8	0.88
Norwalk	4	43	9, 30	0	21.9	0.94	20	52	3	—14	24.4	0.84
Carson	4	44	9	— 2	22.7	0.49	20	51	3	—13	25.1	0.55
North Fairfield	23	45	30	— 6	21.0	0.46	20	51	3	—13	24.1	0.94
Westerville	23	46	30	— 4	20.4	1.81	19	53	3	—10	24.7	0.95
Williamsport	6	50	30	— 2	27.1	6.45	24	69	3	— 2	31.7	1.82
Marion	4	44	30	— 3	20.8	1.84	19, 20	47	3	— 9	23.6	1.00
Hillsboro'	6	49	30	— 4	24.2	4.10	24	54	3	2	28.3	0.68
Toledo	6	40	9, 28	— 1	21.0	1.25*	20	46	3	—10	23.1	1.06
Bowling Green	23	46	28	—14	22.1	3.25	20	52	3	—18	24.9	1.99
Kenton	4	59	30	— 4	27.5	2.44	5, 15	49	3	2	31.2	1.72
Urbana University	4	48	30	— 7	21.8	2.44	19	49	3	— 4	25.1	1.03
Bethel	6	50	30	— 4	24.5	4.25	24	54	1	— 1	27.4	0.70
Cincinnati (H)	5	52	17	4	27.0	3.72	20	51	7	6	31.0	0.57
Do.....(P)	6	55	30	8	31.3	7.29	21	52	7	14	35.3	0.88
College Hill	6	52	30	— 4	25.2	8.90	21, 24	48	7	0	29.8	0.25
Averages	......	......	......	......	23.7	3.30	......	......	......	......	26.5	1.07
MICHIGAN.												
Monroe City	23	49	27	— 6	19.5	2.20	15	47	3	—21	22.5	0.90
Alpena	3	37	12	3	20.9	1.15	20	39	10	— 2	17.4	2.78
State Ag. College	2	38	28	— 5	19.0	1.47	20	41	3	—19	18.7	1.28
Litchfield	2, 23	35	28	—14	16.4	2.34	20	46	3	—30	18.7	1.53
Grand Rapids	5	39	9	1	20.5	4.13	20	48	3, 10	— 6	21.3	1.59
Northport	23	34	26	— 4	20.5	2.98	20	44	13	— 4	18.0	3.45
Holland	2, 19	40	26	— 1	23.4	5.24	16, 20	47	17	— 2	23.5	1.44
Otsego	21	55	27	— 8	23.1	2.00	18	55	3, 10	—10	26.0	1.50
Copper Falls	2, 3, 5	31	11	— 8	11.4	6.80	19	40	2	—16	8.1	4.45
Ontonagon	4, 5	34	7, 8	—14	14.0	......	18, 19	40	10	—22	11.9	......
Averages	......	......	......	......	18.9	3.15	......	......	......	......	18.6	2.10
INDIANA.												
Richmond	4, 6	44	30	— 5	21.2	2.57	24	52	7	— 4	25.0	1.44
Aurora	3, 4, 5, 6	50	30	— 4	26.0	4.32	24	60	1	0	30.3	1.19
Vevay	4	60	30	0	29.2	6.20	19	60	7	5	33.7	0.90

Meteorology of 1868—Continued.

Stations in States and Territories.	January.						February.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
INDIANA—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Muncie	4	46	30	— 5	20.5	2.52	24	55	1	— 6	26.5	1.55
Spiceland	4	47	30	— 1	23.2	2.40	19	53	7	— 4	27.6	2.10
Columbia City	......	......	......	......	......	......	21	50	3	—14	21.9	......
Carthage	......	......	......	......	......	......	24	54	3	— 6	25.0	0.59
Indianapolis	4	48	30	— 3	22.2	2.24	24	56	11	1	26.9	1.13
Merom	4	59	29	— 2	23.8	2.30	24	59	10	1	30.8	1.00
New Harmony	3	58	29	5	27.9	3.60	24	60	10	7	36.2	0.82
Averages	......	......	......	......	24.3	3.27	......	......	......	......	28.4	1.18
ILLINOIS.												
Chicago	4	41	29	— 7	19.8	1.28	20	56	10	— 9	27.8	0.93
Near Chicago	4, 5	40	29	—16	16.8	......	20	54	7	—12	24.3	......
Ridge Farm	5	48	30	—10	20.6	......	24	60	10	— 4	29.3	......
Marengo	1	43	13	— 9	15.5	1.57	20	48	10	—27	20.4	0.95
Golconda	3	66	30	4	27.8	2.20	26	82	10	10	40.1	0.60
Aurora	2	44	29	—11	14.4	0.98	20	51	10	—27	21.3	1.65
Sandwich	2	42	13, 28	—14	14.0	0.85	20	48	10	—25	19.7	0.85
Ottawa	2	47	29	— 6	16.6	1.07	20	55	3	—12	22.0	1.40
Wapello	......	......	......	......	......	......	24	58	3	—15	27.4	1.00
Winnebago	2	39	13	—13	11.5	0.82	20	47	10	—26	18.3	0.77
Rochelle	2	42	13	—16	12.0	......	20	50	10	—32	19.0	0.55
Wyanet	2	50	29	—12	15.6	0.56	19	63	10	—16	24.1	0.52
Tiskilwa	5	44	29	—10	17.2	0.45	20	49	10	—13	24.4	......
Hennepin	5	46	29	—10	17.7	......	20	56	10	—14	25.0	......
Magnolia	1, 5	46	29	—13	18.6	1.70	19	62	3	—16	23.3	0.80
Elmira	2	49	29	—13	16.3	0.34	20	56	10	— 8	24.9	0.83
Peoria	5	51	29	—10	18.4	0.77	20	55	1	— 6	26.8	0.75
Springfield	4	52	29	— 9	18.6	......	20	63	10	— 2	26.9	......
Dubois	4	56	29	— 3	23.0	2.15	24	56	11	0	26.1	0.50
Waterloo	3	63	29	— 2	26.2	......	24	68	10	5	35.7	......
Galesburg	4	48	29, 30	—10	16.4	0.30	20	61	10	— 7	24.5	0.40
Manchester	4	56	17, 29	— 6	20.0	1.19	16	57	10	— 2	29.5	0.19
Mount Sterling	3, 5	54	29	—10	19.4	......	20	58	10	— 6	29.0	......
Andalusia	19	43	29	— 8	15.0	......	16, 19	52	10	—20	26.4	......
Augusta	5	55	29	—10	19.5	0.93	16, 20	56	10	— 6	28.5	0.80
Averages	......	......	......	......	18.7	1.14	......	......	......	......	26.9	0.81
WISCONSIN.												
Manitowoc	2, 5, 6	37	9, 13	—12	15.9	1.64	16, 20	47	10	—17	19.3	1.34
Plymouth	5	38	12, 13	—17	12.0	1.90	16, 18, 20	43	10	—27	17.0	2.00
Milwaukee	7	43	12	— 9	16.4	1.29	19	56	10	—14	21.3	0.92
Appleton	4	37	13	—14	13.6	1.57	20	42	10	—19	16.3	1.50
Geneva	2	40	12	—10	13.7	......	20	48	10	—12	20.2	0.68
Waupacca	4	38	12, 13	—20	13.2	......	18, 20	48	10	—27	17.4	......
Embarrass	4, 5, 6	32	13	—19	12.4	3.20	19	47	10	—23	15.1	3.40
Rocky Run	2	38	12	—18	14.2	1.44	20	49	10	—40	16.9	3.05
Edgerton	4	44	16	—14	......	......	20	56	10	—32	18.6	0.80
Baraboo	4	34	12, 13	—20	9.7	3.31	20	52	10	—30	16.0	4.13
New Lisbon	2, 3, 4, 5, 22	34	12	—33	9.6	......	16	55	10	—40	17.4	......
Bayfield	6	34	7, 8	—22	9.1	......	18	50	9, 12	—24	11.1	......
Averages	......	......	......	......	12.7	2.05	......	......	......	......	17.2	1.98
MINNESOTA.												
Beaver Bay	5	36	12	—27	10.3	2.14	18	49	12	—31	9.9	2.41
St. Paul	5	31	12	—39	4.5	1.71	18	45	10	—26	12.8	1.51
Minneapolis	3, 5	28	12	—40	3.9	1.96	18	46	10	—26	12.7	1.75
Sibley	3	30	13	—36	2.4	0.78	14	47	9	—35	11.5	0.82

Meteorology of 1868—Continued.

Stations in States and Territories.	JANUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	FEBRUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
[illegible]A—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
N[illegible]	1	[illegible]	12, 13	—30	3.8	0.86	16	42	10	—28	13.[illegible]	0.7[illegible]
D[illegible]	3	36	[illegible]	—[illegible]	5.0	.....	16	4[illegible]	[illegible]	—[illegible]	13.4	.....
A[illegible]ages		.....	.....	.....	5.0	1.49	...		.....	.....	[illegible]	[illegible]
IOWA.												
Clinton	5	40	16	— 6	14.8	0.75	20	62	10	—25	23.5	1.00
Davenport	5	44	29	—12	13.2	0.38	20	53	10	—25	22.9	1.74
Dubuque	5	36	16	—12	12.4	0.48	18, 20	51	10	—23	20.6	1.03
Monticello	5	40	29	—16	11.1	0.30	20	57	6, 9	—10	23.0	0.55
Muscatine	5	47	29	—12	13.6	0.30	20	53	10	—32	21.1	1.50
Burlington	2, 4	54	17, 29	— 7	17.5	.....	20	63	10	— 5	29.1	0.45
Ft. Madison	3	50	29	—10	17.8	0.51	20	57	10	—11	27.6	0.40
Guttenberg	5	39	13	—22	8.8	0.63	18	53	10	—37	17.2	0.85
Ceres	5	36	13	—15	12.8	.....	16, 20	48	10	—20	20.0	.....
Mt. Vernon	5	40	29	—15	11.5	.....	18	53	10	—20	21.2	.....
Iowa City	4	50	29	—16	13.4	0.10	18, 20	55	10	—26	25.3	1.51
Independence	3, 5	38	29	—18	9.7	1.65	18	52	10	—31	19.1	0.50
Near Indep'nd'nce	3	39	13	—22	5.9	0.80	18	55	10	—36	15.1	0.95
Waterloo	5	40	16, 29	—15	11.0	.....	18	52	10	—28	17.0	.....
Marble Rock	3, 5	36	13	—20	7.9	1.15	18, 21	45	10	—25	18.6	0.83
Iowa Falls	3	40	29	—16	7.7	1.61	.....	.....	.....	.....	.....	.....
Algona	1	33	29	—19	5.9	0.70	18	42	9	—20	15.3	.....
Near Algona	3	35	29	—20	5.1	0.99	18	44	9	—29	16.7	1.11
Dakota	3	40	29	—20	7.4	.....	18	51	9	—20	18.3	.....
Fort Dodge	3	37	29	15	9.7	0.82	18	53	9	—17	19.9	0.77
Boonesboro'	4	37	29	—18	8.1	0.43	18	55	10	—18	20.7	0.68
Rolfe	3	45	29	—26	8.5	2.00	18, 20	48	9	—24	16.5	1.30
Fontanelle	4	48	29	—18	11.7	0.65	16, 18	58	10	—16	23.2	0.78
Logan	4	48	29	—16	14.3	0.70	16	58	9	—17	25.4	0.61
Whitesboro'	1	41	29	—20	9.1	0.80	18	60	9	—17	22.5	0.65
Averages	.....	.....	.....	.....	10.8	7.89	.....	.....	.....	.....	20.8	0.91
MISSOURI.												
St. Louis Univ	3	61	17, 29	5	26.2	1.23	24	65	10	5	34.9	0.41
Allenton	3	67	29	— 2	24.2	1.69	24	65	11	— 5	33.2	0.82
Canton	5	56	29	—10	18.1	0.60	16, 20	60	10	— 5	29.0	.....
Rolla	4	67	29	0	26.3	1.33	23	69	11	— 3	34.7	0.29
Jefferson City	.....	.....	.....	.....	.....	.....	23	65	10, 11	4	33.0	.....
Hermitage	2	60	21	— 5	23.5	0.63	22	69	11	— 7	33.5	0.15
Harrisonville	4	69	29	— 8	21.1	0.54	16, 21	66	9, 10	0	33.2	0.24
Oregon	4	62	29	—12	17.4	1.00	16	66	9	—10	30.4	1.55
Averages	.....	.....	.....	.....	22.4	1.00	.....	.....	.....	.....	32.7	0.58
KANSAS.												
Atchison	4	60	17	—11	17.1	0.79	16, 18, 23	66	10	—10	29.6	0.25
Leavenworth	2	65	17, 29	—10	18.3	0.56	16, 23	68	10	— 8	30.6	0.38
Olatha	2	57	29	—10	16.0	0.60	16	69	10	— 4	32.0	1.00
Baxter Springs	5	64	29	— 2	24.6	0.46	22	78	11	1	36.9	0.02
Lawrence	2	64	17	— 7	23.7	0.50	23	72	9	— 3	35.7	0.19
Holton	4	58	29	—11	18.3	0.45	16	68	9	—10	30.7	0.28
State Agr. Coll.	2	61	29	—12	18.5	0.30	17	69	9, 10	— 6	27.7	0.18
Council Grove	2	60	29	—10	21.0	0.90	22	75	9	— 4	33.4	.....
Averages	.....	.....	.....	.....	19.7	0.57	.....	.....	.....	.....	32.1	0.33
NEBRASKA.												
Dakota	1	50	27, 29	—18	10.8	0.70	16, 18	56	9	—14	23.2	0.50
Omaha Mission	1, 3	49	29	—12	14.8	0.80	21	62	9	—14	25.3	0.60
Elkhorn	1	45	29	—15	11.7	.....	16	60	9	—13	24.5	0.35
De Soto	1	43	29	—19	11.5	0.70	16	57	9	—17	23.3	0.79

Meteorology of 1868—Continued.

Stations in States and Territories.	January. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	February. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
NEVADA—Cont'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Glendale	4	52	18	—26	11.1	0.85	16	66	9	—22	24.0	1.15
Averages......	......	......	......	......	12.0	0.76	......	......	......	......	24.1	0.6[illegible]
UTAH.												
Gt. Salt Lake City	1	50	18	1	24.3	2.44	......	......	......	......	......	......
Wanship	21	46	16	—18	14.1	1.45	18	49	1	—12	24.2	0.70
Averages......	......	......	......	......	19.2	1.95	......	......	......	......	24.2	0.70
CALIFORNIA.												
San Francisco....	1	59	11	34	46.7	10.32	16	65	9, 10	40	50.3	4.78
Monterey	1	64	8	31	47.1	7.65	17	71	9, 10	29	50.9	1.66
Antioch	1	58	8	31	43.3	7.54	......	......	......	......	......	......
Averages......	......	......	......	......	45.7	8.50	......	......	......	......	50.6	3.22
OREGON.												
Corvallis	2	46	11, 29	0	22.9	......	25	62	1	10	36.6	......
Albany........	1	44	11	— 6	25.4	6.05	......	......	......	......	......	......
Averages......	......	......	......	......	24.1	6.05	......	......	......	......	36.6	......
MONTANA.												
Helena	1	36	9	—28	2.7	1.00	14	54	8	—23	28.1	0.32
Benton	......	......	......	......	......	......	17	68	9	—30	29.7	......
Averages......	......	......	......	......	2.7	1.00	......	......	......	......	28.9	0.32
WASHINGTON.												
Port Townsend ..	1	43	8	16	35.3	1.03	26	54	8	20	40.7	0.55

	March. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	April. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
MAINE.												
Steuben	14	50	1, 2	— 2	29.2	3.80	28	52	13	17	36.2	4.00
West Waterville.	31	55	6	— 5	31.6	3.53	17	64	10	16	38.2	2.53
Gardiner	27, 31	54	6	— 1	33.0	2.38	17	68	5, 10, 13	20	39.8	2.28
Standish	27	53	6	— 2	31.2	2.19	17	67	10	13	39.1	2.59
Norway	31	56	6	— 3	30.9	......	17	68	10	10	37.8	......
Cornish	31	56	1	— 4	31.1	2.07	17	65	5, 13	16	38.7	2.64
Cornishville	31	52	1, 2	— 2	31.6	2.18	17	65	5	16	39.0	2.31
Averages......	......	......	......	......	31.2	2.69	......	......	......	......	38.4	2.73
NEW HAMPSHIRE.												
Portsmouth	14	62	1	1	34.0	......	......	......	......	......	......	......
Stratford	16	59	1	—13	26.2	0.95	16, 29	62	10, 13	9	34.1	2.95
North Barnstead..	15, 17	52	1	0	33.1	2.07	......	......	......	......	......	......
Concord	18	58	6	2	33.0	......	17	69	10	19	42.4	......
Goffstown Center.	31	60	1, 2, 3	10	27.9	......	17, 30	68	13	20	35.6	2.24
Claremont	31	60	1	—10	32.0	2.30	1	67	9, 10	16	39.8	2.94
Averages......	......	......	......	......	31.0	1.77	......	......	......	......	38.0	2.71
VERMONT.												
Lunenburg	31	57	1	—12	28.3	2.80	16	68	10	4	34.3	1.30
North Craftsbury.	31	58	1	— 6	31.8	2.37	16	67	9	14	36.9	2.17

Meteorology of 1868—Continued.

Stations in States and Territories.	MARCH. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	APRIL. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
VERMONT—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Randolph	31	[illegible]	1	—16	28.4	1.66	22	63	10	4	35.1	1.92
Woodstock	31	57	1, 7	—14	......	......	1, 30	63	10	8	36.8	......
Near St. Albans	17	63	1	—23	29.6	......	15, 30	67	6	11	37.3	......
Middlebury	16, 17	58	2	— 9	30.6	2.25	16	65	5	13	38.3	1.77
Averages	......	......	......	......	29.7	2.27	......	......	......	......	36.5	1.79
MASSACHUSETTS.												
Kingston	14, 15	[illegible]	4	2	36.2	4.15	22	72	6	23	43.1	5.80
Topsfield	15	55	1	2	32.2	3.41	22	68	5	21	41.3	5.83
Lawrence	14,15,18	55	2	2	33.7	1.56	22	65	5, 10	23	41.5	5.08
Georgetown	15	56	1, 3	4	32.9	......	......	......	......	......	......	......
Newbury	15	57	1	1	33.3	......	17	68	5	22	41.4	......
Milton	18	61	1	— 1	33.9	1.70	22, 30	68	13	20	39.8	4.42
Brookline	17	71	3	2	37.7	......	......	......	......	......	......	......
Cambridge	......	......	......	......	......	......	1	74	9	27	45.2	......
North Billerica	17,27,31	58	6	— 2	34.6	......	23	69	13	22	42.9	......
West Newton	17	62	1	— 4	35.0	......	23	76	6, 13	22	40.5	3.23
New Bedford	14	58	4	2	35.2	4.52	22	65	5, 9	25	41.8	5.71
Worcester	15	56	3	— 2	33.9	2.82	23	67	9, 13	21	41.2	5.69
Mendon	17	[illegible]	3, 4	— 2	33.1	......	23	69	5, 6, 9, 10, 11	21	40.4	......
Lunenburg	15, 31	58	4	— 3	34.1	2.30	17	69	5, 9	19	41.0	4.90
Amherst	31	60	1	— 7	33.8	3.25	1	68	5, 9, 10	23	42.0	4.27
Richmond	31	67	1	— 4	37.8	3.63	......	......	......	......	......	......
Williams College	17	65	5	— 2	32.0	1.20	30	70	9	18	38.1	2.60
Averages	......	......	......	......	44.4	2.85	......	......	......	......	41.5	4.75
RHODE ISLAND.												
Newport	28, 31	64	4	4	35.9	4.60	28	61	5, 9, 13	26	41.5	6.87
CONNECTICUT.												
Pomfret	15	55	3	— 2	32.4	2.90	23	66	5, 9, 13	20	39.2	4.72
Groton	31	60	4	— 3	34.5	2.47	22	63	9	18	40.6	6.99
Columbia	15	63	3	— 4	36.0	......	1	72	9	23	42.8	......
Middletown	28	63	3	— 5	35.1	2.78	1	71	9	22	42.5	4.48
Colebrook	15	64	3	—10	32.6	......	23	68	5	15	39.9	......
Waterbury	......	......	......	......	......	......	23	68	10	25	42.5	4.99
Averages	......	......	......	......	34.2	2.48	......	......	......	......	41.3	5.29
NEW YORK.												
Moriches	23	70	4	0	39.4	3.29	1	70	6, 9, 13, 14	28	46.0	9.34
South Hartford	31	67	4	— 7	34.8	2.45	22	72	5, 6	21	42.2	2.95
Troy	31	65	1	— 1	35.5	2.06	17	72	10	21	42.9	3.77
Cooperstown	15	70	3	— 1	36.9	4.29	1, 17	72	5, 9, 13, 14	24	43.2	5.60
Garrison's	31	61	3	2	37.0	2.62	23, 30	72	5, 9	25	45.0	5.47
Throg's Neck	31	72	3	3	37.1	......	22	74	9, 13	25	44.5	......
White Plains	17	60	3	9	35.3	......	23	70	9	24	45.8	......
Deaf & Dumb Inst	31	55	3, 4	4	36.7	3.69	23, 27	67	6, 9, 13	25	43.4	6.42
Columbia College	17	59	3	8	39.3	2.60	23	71	5, 13	28	45.9	2.65
Flat Bush	31	58	3	3	36.2	1.35	27	69	13	24	43.3	1.55
Newburgh	31	65	3	— 5	37.5	2.25	27, 30	74	9	26	46.3	4.15
Minaville	31	64	3	—10	28.4	2.73	17, 30	67	10, 13	17	50.3	2.71
Gouverneur	17	63	1	—22	31.1	1.86	15	72	9	12	38.3	1.65
North Hammond	17, 31	70	1	—15	[illegible]	3.93	15	80	5	12	40.4	0.99
Houseville	17	50	1	—12	31.1	[illegible]	15	63	5	10	35.6	2.74
South Trenton	16	65	1	—18	30.4	3.00	1	62	5, 13	12	36.5	3.04
[illegible]	[illegible]	64	1	—10	32.7	......	30	66	5	14	38.8	......
Oneida	16	67	1	—20	......	4.80	17	70	[illegible]	12	41.1	3.99
[illegible]	17	66		—16	32.7	4.47	15	75	5	14	38.8	3.25

Meteorology of 1868—Continued.

Stations in States and Territories.	March. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	April. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
NEW YORK—Con.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Theresa	17	68	1	—22	......	2.23	15	73	5	12	......	2.43
Oswego	17	65	1	0	33.8	3.80	15	75	5	17	39.0	1.53
Palermo	17	60	1	— 8	30.5	2.69	15	73	9	15	37.3	1.50
Nichols	17	66	5	—11	35.3	......	27	73	13	18	41.9	......
Newark Valley	17, 30, 31	60	1, 4	—12	29.8	......	27	69	13	8	37.9	......
Geneva	9, 15	64	3	— 4	35.9	2.46	15	73	5	18	40.3	2.58
Rochester	17	72	3	— 4	34.8	4.38	15	75	5	21	41.2	1.86
Little Genesee	30	68	5	—22	33.6	2.80	28	74	9	9	38.3	1.75
Suspension Bridge	17	64	3	— 5	38.0	......	27	68	5, 8, 9, 12	22	41.6	......
Buffalo	28	63	3	—11	34.7	4.66	15	79	5, 9	19	40.9	1.86
Averages	......	......	......	......	34.4	3.11	......	......	......	......	41.7	3.20
NEW JERSEY.												
Paterson	14, 31	62	3	1	37.2	2.68	23	72	6	22	44.7	5.35
Newark	31	61	4	2	37.3	2.17	23	73	13	21	45.1	5.26
New Brunswick	17	77	3	4	36.2	1.60	23	72	13	23	44.6	4.62
Trenton	17	68	4	1	41.2	2.99	......	......	......	......	......	......
Burlington	17	80	4	4	41.2	3.60	......	......	......	......	......	......
Moorestown	17	79	3	2	38.1	2.68	15	75	13	27	46.1	5.09
Mount Holly	17	80	4	2	40.0	......	......	......	......	......	......	......
Elwood	17	75	4	4	40.2	......	15	71	6	19	46.6	......
Rio Grande	......	......	......	......	......	......	2	71	13, 14	28	46.9	......
Seaville	......	......	......	......	......	......	1	84	9	28	45.5	6.15
Dover	17	68	3	1	36.8	2.41	23	73	5, 6, 9	25	44.4	2.85
Haddonfield	17	78	3	4	39.0	3.54	1	69	13	22	44.4	5.55
Newfield	17	80	1, 3, 4	4	39.6	......	15	73	6	22	46.3	......
Greenwich	17	76	3	8	40.2	5.31	23, 30	72	13	25	47.7	3.87
Vineland	17	81	3, 4	5	41.9	4.82	30	80	13	24	47.1	5.19
Averages	......	......	......	......	42.4	3.18	......	......	......	......	45.8	4.82
PENNSYLVANIA.												
Nyces	15	70	1	—10	35.7	3.30	1	71	5, 13	18	41.0	4.30
Fallsington	17	78	4	0	39.3	2.50	1, 23	71	6	25	46.0	4.10
Philadelphia	17	76	3	9	40.9	3.80	23	70	12	30	47.2	4.29
Germantown	17	80	3	2	38.0	......	......	......	......	......	......	......
Horseham	17	80	3	2	38.2	3.01	23	73	5	26	48.9	3.94
Plymouth Meet'g	17	78	3, 4	5	38.2	......	23	73	13	23	45.7	......
Dyberry	17	69	5	—22	32.0	......	28	71	13	10	38.5	......
Lehigh University	31	60	3	2	35.9	......	23	74	5, 6, 13	25	43.2	......
Whitehall	31	62	1	— 2	36.5	......	23	72	14	20	43.6	......
Factoryville	17	69	5	—20	34.4	......	27, 28	70	5, 9	18	40.2	3.82
Reading	31	65	3	5	39.0	......	23	78	13	25	47.1	......
Parkersville	17	75	5	0	37.1	3.20	23	74	5, 9, 12	28	45.4	4.29
Ephratah	15. 31	65	3	0	40.3	2.37	23	78	6, 13	24	47.1	2.16
Silver Spring	17	70	3	4	39.0	......	23	80	5, 13	26	47.0	......
Mount Joy	......	......	......	......	......	......	23, 30	75	13	13	47.5	......
Harrisburg	31	62	3	6	38.6	2.47	23	73	13	25	45.8	5.02
Fountain Dale	......	......	......	......	......	......	30	80	5	24	47.6	4.27
Tioga	30	74	3	—20	32.8	2.05	28	78	9	12	41.1	3.69
Lewisburg	31	64	5	—11	35.0	2.38	30	73	5	22	43.6	3.85
Ickesburg	15	71	3	— 2	37.2	2.31	23, 30	75	13	17	41.4	4.28
Murrysville	15	71	3	— 3	41.0	3.44	......	......	......	......	......	......
Grampian Hills	31	63	3	—14	32.7	4.63	28	74	5, 9, 13	10	36.9	4.56
Johnstown	8, 15	64	3	0	38.0	3.80	29	68	13	15	40.2	7.55
Franklin	15	68	3	—25	36.2	......	15	75	13	15	40.0	......
Connellsville	15	72	3	— 7	42.8	......	28	79	5	20	46.4	......
New Castle	15	68	3	— 7	40.9	......	15	77	13	11	44.5	......
Beaver	15	69	3	0	43.3	3.20	28, 30	75	5, 8, 12, 13	30	46.5	......
Canonsburg	16	76	3	— 4	43.0	3.76	15	73	13	20	44.2	2.54
Averages	......	......	......	......	37.9	3.04	......	......	......	......	39.0	4.03
MARYLAND.												
Woodlawn	17	80	4	0	39.4	3.00	1	73	13	27	46.8	4.16

Meteorology of 1868—Continued.

Stations in States and Territories.	March. Date.	March. Maximum temperature.	March. Date.	March. Minimum temperature.	March. Mean temperature.	March. Rain and melted snow.	April. Date.	April. Maximum temperature.	April. Date.	April. Minimum temperature.	April. Mean temperature.	April. Rain and melted snow.
MARYLAND—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Annapolis	16	70	4	6	43.5	3.41	30	71	6	27	50.0	3.74
St. Inigoes	17	76	4	12	44.7	3.69	28	72	5, 9	31	50.0	1.75
Emmittsburg	15	72	3	2	39.5	......	30	82	5, 13	24	46.7	......
Mt. St. Mary's Col.	15	66	3	2	39.6	2.43	30	77	13	22	46.4	4.16
Averages					41.3	3.13					48.0	3.45
VIRGINIA.												
Surry Court House	17	88	4	16	51.7	......	30	87	5	32	57.5	......
Johnsontown						......	30	76	6	30	52.2	......
Comorn	17	86	3, 4	15	48.7	0.24	30	82	5, 9	32	55.2	0.59
Mount Solon	17	82	3	12	48.3	......	30	82	6	28	53.8	......
Lynchburg	17	76	3	19	49.2	......	30	74	6	31	51.3	......
Snowville	16	74	3, 4	12	45.5	13.25	30	81	6	22	48.1	14.63
Wytheville			3	10	46.0	2.30	2	83	6	28	49.8	3.31
Averages					48.2	5.26					52.6	6.18
WEST VIRGINIA.												
Romney	15	78	3	6	44.4	......	30	82	5	24	50.1	......
Burning Springs	16	104	2, 3	10	53.1	......						......
Cabell Court House	15, 16	76	3	8	49.2	2.70	24	64	6	28	46.7	1.70
Averages					48.9	2.70					48.4	1.70
NORTH CAROLINA.												
Kenansville	17	85	3, 4	20	50.9	2.36	30	84	14	37	59.4	9.96
Goldsboro'	17	84	4	23	53.6	3.35	30	87	6	38	59.6	5.25
Raleigh	17	84	5	18	50.9	4.60	30	87	13, 14	36	53.5	3.80
Oxford	17	80	3, 4	22	49.0	4.20	30	80	6	33	53.7	3.50
Albemarle	17	88	5	16	51.6	4.70	30	91	4, 8	32	58.8	6.69
Statesville	17	81	4	15	47.7	3.25	30	82	6, 14	30	51.7	7.56
Asheville	24	75	3	17	48.9	......	30	78	6	31	53.2	......
Averages					50.2	3.74					55.7	6.13
SOUTH CAROLINA.												
Aiken	16	84	4, 5	32	55.8	3.51	30	87	14	39	57.0	9.34
Gowdysville	24	82	4, 5	22	52.9	......	30	83	13	35	58.5	......
Averages					54.4	3.51					57.8	9.34
GEORGIA.												
Atlanta	24	83	4	22	54.5	2.71	29	85	8	29	58.2	6.88
Macon	16	85	3	34	60.1	4.35	30	85	8	42	62.8	11.36
Penfield	16	83	3, 4	30	57.2	3.40	13	66	8, 14	38	60.0	5.65
Averages					57.3	3.49					60.3	7.96
ALABAMA.												
Opelika	24	82	3	32	60.6	......	28	87	8	39	63.4	5.75
Carlowsville	14, 15, 24	82	3	31	62.2	3.50	14, 30	86	8	42	66.2	10.46
Moulton	16	78	3	30	55.6	5.54	30	80	6	41	58.6	7.37
Fish River	15, 16	84	4	30	63.5	2.20						......
Greene Springs	16	85	3	34	60.6	3.51	13	85	8	36	65.9	7.27
Havana	24	82	3, 4	34	60.0	3.52	13	84	8	37	64.8	8.33
Averages					60.4	3.65					63.8	7.84
FLORIDA.												
Jacksonville	16, 17	90	5	46	66.7	1.35	20	92	8	50	72.0	2.83

Meteorology of 1868—Continued.

Stations in States and Territories.	MARCH. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	APRIL. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
FLORIDA—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Port Orange	14	85	23	44	64.6	......	12	88	7	48	71.3	......
Lake City	16, 17	84	4	39	62.8	2.83	26	85	5	43	68.5	1.88
Averages	......	......	......	......	64.7	2.12	......	......	......	......	70.6	2.36
TEXAS.												
Gilmer	14	84	3	34	61.3	......	29	85	3	47	66.3	......
Houston	10	80	3	41	67.8	......	30	81	3	62	71.9	......
Columbia*	15	88	3	40	67.1	1.76	23	91	4	50	71.4	5.96
Waco	22	83	3	38	63.7	10.60	30	88	1	34	67.8	5.40
Austin	14, 16	83	3	40	64.7	4.55	15	89	26	50	68.2	3.63
Averages	......	......	......	......	64.9	5.64	......	......	......	......	69.1	5.00
LOUISIANA.												
New Orleans	16	83	3	53	......	......	15	82	4, 8	46	65.6	......
Benton	24	82	3	33	61.6	......	13, 24, 29	84	8	47	65.4	......
Averages	......	......	......	......	61.6	......	......	......	......	......	65.5	......
MISSISSIPPI.												
Grenada	16	80	3, 4	34	59.0	......	14	84	8	33	62.6	......
Brookhaven	24	82	3	39	62.0	......	12, 30	85	4	45	66.6	......
Natchez	16	89	3	37	63.2	8.42	13, 14	81	4	42	69.9	7.97
Marion	24	88	3	28	61.0	8.70	28, 29	88	8	32	67.3	13.66
Averages	......	......	......	......	61.3	8.56	......	......	......	......	66.6	10.81
ARKANSAS.												
Helena	24	86	3	32	59.2	......	13, 30	89	7	39	62.0	......
TENNESSEE.												
Elizabethton	10	79	4	16	50.1	......	30	81	6	30	53.2	......
Tusculum College	......	......	......	......	......	......	24, 29	79	5	32	56.2	......
Lookout Mountain	25	89	3	21	55.1	......	30	82	6, 7	35	60.4	......
Austin	16	82	3	22	57.5	5.21	30	84	6	26	58.4	9.80
Clarksville	15, 16	78	3	21	55.0	5.52	29, 30	80	5	31	55.4	7.61
Memphis	24	82	3	27	57.4	4.17	30	85	8	38	60.1	7.96
Averages	......	......	......	......	55.0	4.97	......	......	......	......	57.3	8.46
KENTUCKY.												
Pine Grove	15, 16, 25	76	3	10	49.9	3.47	29, 30	78	5	22	53.8	4.34
Lexington	25	76	3	11	53.7	3.86	29, 30	76	5	29	51.9	4.92
Danville	25	82	4	18	......	......	29	84	5	28	56.6	4.79
Louisville	23	78	3	17	52.6	6.83	30	79	5	23	63.1	6.05
Averages	......	......	......	......	52.1	4.72	......	......	......	......	53.9	5.03
OHIO.												
New Lisbon	17, 24, 25, 31	65	3	—12	40.4	3.12	27, 29	68	6, 13	20	43.8	2.84
Steubenville	15	67	3	0	44.0	......	28	76	5	23	48.0	......
Milnersville	23	76	3	—10	38.2	3.97	29, 30	75	6	20	45.5	1.42
Cleveland	17	67	3	— 5	37.2	4.20	29	77	12	20	42.5	2.97
Wooster	15	74	3	—20	42.0	......	28	77	6	23	47.4	......
Gallipolis	15	76	3	3	48.5	3.69	30	78	5, 9, 13	28	51.1	5.06
Kelley's Island	23	62	2	— 5	36.2	3.91	29	66	5	22	42.2	1.83
Sandusky	15	65	3	— 5	38.2	5.98	29	74	5	18	43.8	4.13
Norwalk	15	72	3	— 6	39.4	3.57	29	76	5	16	43.7	1.69
Canton	23	70	3	— 8	41.1	3.93	28	78	5	12	46.6	1.67

Meteorology of 1868—Continued.

Stations in States and Territories.	March.						April.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
OHIO—Con.												
		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
North Fairfield	15	72	3	—13	39.6	4.77	28	78	5	18	44.6	1.84
Westerville	15	71	3	— 3	41.3	7.93	29	76	5	22	47.6	3.57
Marion	23	69	3	—11	39.6	7.42	28, 29	72	5	19	44.3	3.85
Hillsboro'	15	71	3	3	44.5	6.59	29	74	5	23	47.4	4.12
Toledo	15, 23, 30, 31	62	3	— 6	33.3	8.75	29	71	5	13	42.5	3.38
Bowling Green	23	77	3	—24	39.9	14.00	27	75	5	3	44.5	5.55
Kenton	16	60	3	4	39.8	12.72	30	70	6, 7, 9, 13	30	43.8	2.44
Urbana University	15, 23	72	3	0	42.6	7.51	30	76	5	22	46.7	3.35
Bethel	15	73	3	4	46.0	5.75	29, 30	75	5	24	47.3	3.50
Cincinnati (H)	15	74	3	8	47.0	4.87	29	74	5	25	49.1	2.72
Do. (P)	15	75	3	14	50.7	5.41	30	85	9, 13	33	53.7	3.30
College Hill	15	73	3	6	45.8	10.48	30	75	6	26	48.5	4.44
Averages	....	......	....	......	41.8	6.43	....	......	....	......	46.1	3.18
MICHIGAN.												
Monroe City	30, 31	71	3	— 8	37.0	3.35	27	75	4, 8, 10	23	44.3	2.87
Alpena	30	45	2	0	30.0	3.10	28	48	5	15	33.7	1.32
State Ag. College	30, 31	64	4	— 7	37.8	4.65	28	72	5	17	42.7	1.83
Litchfield	23	69	4	—10	37.0	5.02	27	72	4	12	40.5	3.38
Grand Rapids	31	68	4	— 6	38.1	......	28	76	5	17	41.8	......
Northport	31	64	4	—11	31.2	......	27	70	5, 8	16	37.5	......
Holland	16	68	4	— 8	38.4	4.50	28	70	8	21	41.7	2.58
Otsego	14, 15, 16, 29	68	4	— 2	40.0	......	25, 26	72	4	16	45.7	......
Copper Falls	29	53	2	— 5	26.6	2.95	26	51	2	5	14.3	3.90
Ontonagon	29, 30, 31	50	3	—10	27.2	......	20	62	9	4	33.2	......
Averages	....	......	....	......	34.3	3.93	....	......	....	......	37.5	2.65
INDIANA.												
Richmond	23	70	4	2	42.3	7.70	29	71	5	23	45.8	4.62
Aurora	23	76	3	8	48.2	6.99	29	80	5	22	50.9	3.69
Vevay	23	82	3	10	50.3	5.40	27, 29	85	5	23	53.1	3.95
Muncie	23	76	4	4	43.5	10.00	22, 27	74	4, 5	25	46.9	5.25
Spiceland	23	74	4	5	43.7	7.10	22	72	4, 5	25	47.1	5.70
Columbia City	23	78	3, 4	— 2	39.7	8.00	28	74	5	22	45.1	6.24
Carthage	23	72	2	0	44.5	7.75	22	72	5	25	46.9	4.94
Indianapolis	23	76	4	7	44.6	7.09	....	......	....	......	......	......
State University	23	72	3	14	46.9	7.58	30	71	5	25	48.8	5.17
Rensselaer	23	77	3, 4	8	42.9	11.25	22	72	4	22	44.2	6.90
Merom	23	73	3	7	47.8	8.55	30	72	5	25	49.6	2.00
New Harmony	23	78	38	15	52.0	6.40	30	77	5	32	53.6	5.52
Averages	....	......	....	......	45.7	7.82	....	......	....	......	48.4	4.91
ILLINOIS.												
Chicago	16	72	3	5	43.8	5.25	21	73	5	19	45.9	3.00
Near Chicago	23	84	3	— 4	41.7	......	26	70	4, 5	14	43.8	......
Ridge Farm	....	......	....	......	......	......	22	74	4	28	42.5	2.50
Marengo	23	75	3	— 8	38.1	5.40	27	69	5	9	41.4	6.06
Golconda	16	84	3	12	53.1	4.10	24	87	4, 5	26	58.0	4.20
Aurora	23	71	3	—10	38.0	6.88	27	67	5	14	42.2	4.56
Sandwich	23	74	3	— 8	39.6	4.86	22	72	4	18	43.2	2.45
Belvidere	....	......	....	......	......	......	27	70	4	15	40.9	......
Ottawa	23	78	2	1	42.6	4.48	22, 27	79	4	24	45.7	2.50
Wapello	23	80	3	—13	45.5	4.88	....	......	....	......	......	......
Winnebago	23	73	3	— 9	38.3	4.78	27	71	5	17	41.1	4.43
Rochelle	16	74	3	—12	38.5	......	27	72	5	13	42.1	......
Wyanet	23	74	3	— 6	42.3	4.75	....	......	....	......	......	......
Tiskilwa	23	77	3	0	42.8	......	22	74	5	22	45.0	......
Magnolia	23	82	3	— 5	43.2	6.50	27	82	5, 10	26	47.3	4.50
Elmira	16	76	2	6	44.7	5.73	22	78	5	23	46.5	3.15
Peoria	23	75	3	9	45.7	5.38	22	79	5	22	47.6	3.18

Meteorology of 1868—Continued.

Stations in States and Territories.	MARCH. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	APRIL. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
ILLINOIS—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Springfield	16	75	3	4	44.0	......	30	78	5	26	45.6	......
Dubois	15	74	3	8	43.8	8.43	30	77	5	21	47.6	8.20
Waterloo	23	80	3	18	51.3	......	29	82	5	26	49.0	......
Galesburg	16	75	3	4	43.2	5.40	22	75	9	25	44.6	5.54
Manchester	15	79	3	11	47.6	5.81	22	78	13	20	48.2	5.60
Mt. Sterling	23	85	2, 3	12	48.9	......	22	78	5, 9	26	49.3	......
Andalusia	16, 23	74	3	2	44.1	......	22	72	5	22	46.0	......
Augusta	23	75	3	10	47.6	5.63	22	72	9	23	48.8	5.37
Averages	....	......	....	......	44.7	5.52	....	......	....	......	45.7	4.35
WISCONSIN.												
Manitowoc	31	70	3	— 3	35.0	3.87	27	42	4, 8	18	39.3	1.92
Plymouth	31	67	3	— 8	33.0	3.20	27	71	8	13	38.4	3.20
Wilwaukee	31	70	3	0	36.2	4.59	21	70	5	16	39.9	2.97
Appleton	31	62	3	— 5	33.3	1.35	27	64	8	13	39.1	......
Geneva	23	74	3	— 3	35.3	......	27	70	5	6	41.0	......
Waupacca	31	71	3	—17	35.0	......	27	72	8	10	40.7	......
Embarrass	31	66	3	—13	32.6	3.61	27	72	5	12	37.4	3.00
Rocky Run	....	......	....	......	......	......	27	73	8	17	41.0	1.50
Edgerton	23, 29	80	3	—12	38.5	7.75	21, 27	75	5	9	42.2	4.05
Baraboo	29	66	2	— 2	40.0	11.25	25, 26, 27, 28	70	8	12	43.0	......
New Lisbon	31	73	3	—22	36.7	......	28	72	8	12	41.1	......
Bayfield	31	76	3	—20	28.2	......	....	......	....	......	......	......
Averages	....	......	....	......	34.9	5.09	....	......	....	......	40.3	2.77
MINNESOTA.												
Beaver Bay	31	65	3	—26	26.5	1.51	20	55	10	3	30.8	2.05
St. Paul	31	70	3	—12	32.6	1.22	27	72	8	9	39.1	0.76
Minneapolis	31	67	3	—15	32.2	0.90	27	72	8	8	38.6	2.01
Sibley	31	67	2, 3	— 6	31.7	1.02	27	72	5, 8	10	37.3	0.90
Danville	30	69	2	2	36.5	......	27	72	8	10	39.2	......
New Ulm	31	71	2	0	34.5	0.51	27	74	8	12	40.5	2.11
Averages	....	......	....	......	32.3	1.03	....	......	....	......	37.6	1.57
IOWA.												
Clinton	23, 30	72	3	— 4	41.9	8.50	22, 26, 30	70	4, 5	24	43.6	6.75
Davenport	16	71	3	3	41.6	11.84	22	71	8	24	43.7	10.17
Dubuque	16	71	3	— 1	39.5	3.83	27	70	9	18	42.9	1.99
Monticello	23	77	3	0	41.9	4.02	30	73	5, 8	22	44.5	2.78
Burlington	31	79	3	14	47.6	......	21	72	5	25	46.9	......
Fort Madison	16	76	3	7	45.4	5.94	22	75	5	18	45.5	7.57
Guttenberg	16, 31	74	3	— 8	36.1	......	27	74	5, 8	16	40.3	......
Ceres	23	78	3	5	41.7	......	21	70	8	18	42.5	......
Mt. Vernon	16, 23	75	3	5	41.2	......	22	76	5	20	42.9	......
Iowa City	31	75	3	3	42.7	6.31	21	78	5	18	44.5	4.70
Independence	16, 23	74	3	— 1	39.0	3.00	27	75	5	17	42.4	2.10
Near Independ'ce	23	76	3	— 8	38.3	2.15	27	77	5	16	41.2	2.90
Waterloo	23	77	3	— 2	39.0	......	27, 30	72	5	15	40.8	......
Marble Rock	23, 31	70	3	3	37.9	......	....	......	....	......	......	......
Iowa Falls	23	74	3	2	35.3	3.82	30	70	5	20	41.9	3.97
Algona	31	68	3	4	35.5	......	27	66	3	13	40.7	......
Near Algona	31	68	3	2	36.4	......	27	70	3	16	40.8	......
Dakota	23	73	3	3	39.1	......	....	......	....	......	......	......
Fort Dodge	23, 31	74	3	5	38.7	3.16	30	71	3	17	41.6	1.86
Boonesboro'	23	80	2	0	38.0	4.49	11	80	5	16	......	......
Rolfe	30	70	2	4	37.2	3.00	30	73	5	14	44.9	1.58
Fontenelle	23	82	2	9	41.6	3.76	22	78	5	17	43.1	6.13
Logan	22, 23, 24	84	2	13	43.0	2.40	11	76	5	12	43.4	2.60
Whitesboro'	22	81	2	6	40.1	......	11	78	3	18	42.7	......
Averages	....	......	....	......	39.9	4.73	....	......	....	......	42.9	3.55

Meteorology of 1868—Continued.

Stations in States and Territories.	March. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	April. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
MISSOURI.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
St. Louis Univer'y	23	80	3	16	52.3	6.54	22	77	5	30	51.5	5.89
Allenton	23	88	3	14	50.2	8.87	30	85	5	28	51.4	6.05
Hematite	23	84	3	18	51.6	8.40	29	80	5	28	52.8	7.40
Canton	23	82	3	12	46.9	4.67	22	80	5	24	46.5	7.47
Canton University	23	80	3	15	48.3	......	22	80	5	25	49.4	......
Rolla	25	87	3	19	51.2	6.59	29	82	5	25	51.0	7.34
Jefferson City	23	80	3	18	[illegible]	......	30	79	5	29	[illegible]	......
Hermitage	23	84	2	21	50.9	2.93	30	79	3	30	51.8	4.93
Harrisonville	23, 29	88	3	20	50.8	2.22	11, 22, 23, 30	76	5	26	47.7	2.51
Oregon	23, 24	87	2	17	48.5	3.60	22	83	2	22	47.7	3.43
Averages	......	......	......	......	50.0	[illegible]	......	......	......	......	50.9	5.63
KANSAS.												
Atchison	23	92	2	18	48.7	5.80	21, 22	82	5	23	48.7	7.10
Leavenworth	23	95	2	15	49.0	5.16	11, 21	83	5	22	47.7	3.44
Olathe	23	91	2	17	48.7	7.70	30	83	9	29	48.9	5.90
Baxter Springs	23	84	2	24	51.6	3.12	30	83	5	32	50.4	2.80
Lawrence	23	93	2	22	50.9	3.46	11	83	5	25	49.7	2.95
Holton	23	91	2	15	48.3	......	21, 23	83	2	26	48.2	......
State Agr. College	28	87	2	19	49.4	0.93	11	83	5	27	46.6	1.96
Council Grove	23	92	2	23	52.3	4.45	22	82	2	26	50.6	2.65
Averages	......	......	......	......	49.9	4.38	......	......	......	......	49.6	3.83
NEBRASKA.												
Dakota	22, 23	80	......	......	40.4	......	30	72	3	21	44.3	......
Omaha Mission	22	80	2, 3	15	42.0	1.32	30	79	3	23	45.9	1.00
Elkhorn	24	85	2	12	42.7	......	30	73	3	20	44.2	......
De Soto	24	86	2	11	41.7	2.74	11	78	3	22	44.5	3.16
Bellevue	24	90	2	10	45.3	1.90	21, 30	76	3	24	47.3	2.60
Glendale	24	92	2	4	43.9	2.75	22	89	3, 8	22	45.5	3.60
Averages	......	......	......	......	42.7	2.18	......	......	......	......	45.3	2.59
UTAH.												
Wanship	22	59	11	9	35.1	2.00	......	......	......	......	......	......
CALIFORNIA.												
San Francisco	19	63	5, 13, 23	45	51.5	7.54	24	72	15	48	52.7	2.35
Antioch	29, 30, 31	68	13	39	52.3	3.48	24	74	18	47	67.9	1.15
Murphy's	29	78	6, 9, 13	30	49.0	9.87	25	80	13	34	54.8	2.91
Averages	......	......	......	......	50.9	6.96	......	......	......	......	58.5	2.14
OREGON.												
Corvallis	31	76	24	28	......	......	......	......	......	......	......	......
WASHINGTON.												
Port Townsend	......	......	......	......	......	......	1	65	11	40	52.2	0.65
	MAY.						JUNE.					
MAINE.												
Steuben	31	66	1	32	48.8	10.05	27	82	9	47	58.7	2.00
West Waterville	31	76	1, 2	34	51.9	8.97	20	96	12	50	64.6	2.84
Gardiner	31	69	1, 8	36	51.9	9.58	26, 27	81	4	45	63.0	3.20

Meteorology of 1868—Continued.

Stations in States and Territories.	MAY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	JUNE. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
MAINE—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Standish	31	75	8	33	54. 5	10. 16	20	[illegible]	3, 4	48	65. 4	2. 87
Norway	28	72	2, 8	32	51. 7	.....	20	90	3	40	64. 4	......
Cornish	28, 31	74	8	33	51. 3	10. 18	20	89	3, 4	49	64. 3	3. 11
Cornishville	28	76	8	33	51. 1	8. 32	20	89	3, 4	50	65. 3	3. 58
Averages	....	......	....	......	51. 2	9. 54	....	.....	....	......	64. 8	2. 93
NEW HAMPSHIRE.												
Portsmouth	....	......	....	......	......	.....	15,20,27	90	11	50	64. 0	......
Stratford	8	88	1, 2	32	52. 5	3. 84	18	95	2	42	63. 3	2. 30
Concord	31	78	8	36	54. 1	.....	20	93	11	42	67. 2	......
Goffstown Center	29, 31	74	2	40	55. 2	10. 33	19, 20	94	5	40	66. 2	3. 50
Claremont	28	77	4, 8	35	55. 3	4. 00	20	90	10	45	66. 5	3. 60
Averages	....	......	....	......	54. 3	6. 09	....	.....	....	......	65. 4	3. 13
VERMONT.												
Lunenburg	28	77	9	32	62. 8	4. 66	18	87	3	36	63. 6	4. 40
North Craftsbury	28	78	1	30	51. 5	4. 62	18	90	2	42	63. 3	2. 75
Randolph	27, 28	78	1	33	55. 2	5. 35	17	95	10	45	65. 8	3. 01
Woodstock	28	75	1, 8	34	52. 4	......	18	88	2	47	63. 1	......
Near St. Albans	28, 29	80	1	30	54. 8	......	18	90	2	48	65. 9	......
West Charlotte	29	88	1	31	56. 9	6. 50	18	96	2, 3, 10	48	70. 0	3. 31
Middlebury	29	75	1	31	54. 9	4. 54	17, 20	82	2	47	64. 8	3. 49
Averages	....	......	....	......	55. 5	5. 08	....	.....	....	......	65. 2	3. 39
MASSACHUSETTS.												
Kingston	28	75	1	35	53. 3	9. 25	20	94	3, 4	40	64. 7	2. 00
Topsfield	28, 31	72	8	34	50. 7	8. 72	20	89	3	46	64. 6	1. 99
Lawrence	....	......	....	......	......	......	20	89	11	47	64. 7	2. 67
Georgetown	26	78	8	36	50. 6	9. 20	....	.....	....	......	......	......
Newbury	31	79	8	32	51. 4	......	20	92	3	46	65. 2	......
Milton	31	76	8	34	50. 7	8. 31	20	93	4	45	66. 1	2. 62
Cambridge	31	88	8	35	52. 2	......	19	98	4, 11	49	67. 5	......
North Billerica	16,28,31	78	8	32	54. 3	......	20	88	3	48	67. 3	......
West Newton	31	82	8	37	54. 6	11. 62	20	98	4	52	68. 2	2. 03
New Bedford	31	76	1	38	52. 8	9. 44	27	82	28	52	62. 9	6. 31
Worcester	28	75	8	34	54. 0	8. 84	20	87	11	49	65. 3	3. 08
Mendon	17, 31	71	8	32	50. 2	6. 70	20	87	11	49	64. 2	2. 30
Lunenburg	27	78	8	34	53. 9	11. 05	20	91	11	49	66. 7	4. 05
Amherst	27	75	8	36	55. 1	7. 86	20	89	11	51	66. 2	2. 44
Richmond	27	77	1	33	56. 5	6. 04	19	92	10	42	68. 6	7. 94
Williams College	16	88	8	34	54. 4	0. 63	19, 20	88	3	47	69. 0	1. 82
Averages	....	......	....	......	53. 0	8. 14	....	.....	....	......	66. 1	3. 27
RHODE ISLAND.												
Newport	27, 31	71	8	37	52. 2	8. 88	13	79	2, 4, 12	50	60. 5	3. 48
CONNECTICUT.												
Pomfret	27	71	8	33	50. 9	7. 71	8	88	11	46	62. 9	3. 19
Columbia	27	88	8	36	53. 9	......	20	90	5	50	66. 9	......
Middletown	27	77	8	35	55. 3	7. 63	20	91	4	50	65. 7	4. 82
Colebrook	27	78	8	36	54. 2	......	19, 20	89	11	48	64. 7	......
Waterbury	27	72	8	36	54. 8	9. 35	20	84	11	48	65. 1	5. 11
Averages	....	......	....	......	53. 8	8. 23	....	.....	....	......	65. 1	4. 37
NEW YORK.												
Moriches	31	76	4	42	55. 4	8. 91	20	89	4	55	68. 7	2. 74
South Hartford	17	81	1	35	58. 1	6. 20	18	93	7	52	69. 9	2. 90

Meteorology of 1868—Continued.

Stations in States and Territories.	MAY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	JUNE. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
NEW YORK—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Troy	27	76	1	38	57.6	6.33	19, 20	88	2	52	68.8	3.20
Garrison's	27	75	7	41	57.0	8.08	20	92	11	53	67.5	4.43
Throg's Neck	14, 31	74	8	42	55.6	......	20	90	4	53	67.7	......
White Plains	27	72	7	38	55.5	......	20	85	4, 26	51	66.2	......
Deaf & Dumb Inst.	27	69	8	41	54.7	7.19	20	87	5, 11	53	66.6	5.86
Columbia College	31	69	8	41	54.9	5.84	20	90	5, 11	53	67.8	3.59
Flat Bush	25	72	7	40	54.2	5.08	19, 27	85	4	49	66.3	3.35
Newburg	27	80	8	42	57.6	6.82	20	92	11, 12	54	69.5	3.22
Minaville	27, 30	74	8	34	54.3	7.40	18	92	2	50	67.6	3.30
Gouverneur	27	83	1	32	55.3	4.23	16	89	3, 9	48	66.7	1.83
North Hammond	27	88	1	32	57.0	5.37	16	96	7	50	70.2	0.72
Houseville	27	78	1	30	54.1	1.61	15, 17, 18	86	2	43	65.4	4.53
South Trenton	29	80	1	30	50.2	7.74	14	92	1	40	65.8	3.82
Cazenovia	27	79	1	32	53.8	......	18	87	2	46	64.7	......
Oneida	27	82	13	35	57.0	10.05	15, 18	90	2	46	65.0	6.83
Depauville	27	82	1	32	54.8	5.48	14	86	2, 7	46	63.6	2.04
Oswego	27, 29	77	1	36	51.2	3.35	15, 30	82	7	44	61.2	3.14
Palermo	27	83	1	34	54.0	2.60	15	93	2	41	65.7	2.80
Nichols	27	82	1, 10	37	55.3	......	18	96	2	44	66.2	......
Newark Valley	27	80	11	34	52.6	......	18, 19	90	10	44	64.0	......
Geneva	27	81	1	35	53.8	3.74	18	87	3, 7	47	67.0	3.12
Rochester	27	83	1, 7, 18	40	54.8	6.36	19	84	7	48	66.4	2.87
Little Genesee	26	80	11	25	53.1	3.65	15, 18	92	10	40	64.7	3.95
Suspension Bridge	27	80	1	38	55.7	......	15	96	10	42	64.8	2.65
Buffalo	26	81	8	37	54.1	4.35	15	91	9	47	67.0	2.51
Averages	......	......	......	......	54.9	5.73	......	......	......	......	66.5	3.34
NEW JERSEY.												
Paterson	26	76	8	42	57.1	9.39	20	92	11	52	67.6	6.81
Newark	31	71	8	38	55.3	6.92	20	86	3	50	65.9	5.90
New Brunswick	27	71	2	41	55.3	7.70	20	91	4, 5	58	67.3	6.45
Trenton	31	74	8	46	60.7	6.98	20	89	5	57	72.3	6.23
Moorestown	27	76	2	41	56.4	5.87	20	90	4, 5	52	68.9	3.42
Elwood	30	80	4	32	56.9	......	20	94	3	49	68.5	......
Rio Grande	26	76	4	40	56.3	......	27	93	3	56	71.3	......
Dover	27	73	8	40	55.1	8.54	20	88	4, 11	52	67.1	6.81
Haddonfield	27, 30	75	8	42	56.4	7.45	20	90	12	53	67.9	2.75
Newfield	30	83	7, 8	43	57.4	......	20	96	4	55	71.0	......
Greenwich	30	77	3, 7, 8	45	58.4	5.31	20	88	3	56	69.8	3.38
Vineland	30	90	8	44	59.2	6.69	20	100	11, 12	56	72.7	3.95
Averages	......	......	......	......	57.0	7.21	......	......	......	......	63.9	5.08
PENNSYLVANIA.												
Nyces	30	75	8	35	53.2	8.90	18	93	10	49	67.4	3.55
Fallsington	27	79	5, 8	43	57.3	6.40	20	89	4	53	68.1	7.00
Philadelphia	30	77	8	42	58.3	6.89	20	88	5, 11	55	71.9	3.69
Germantown	......	......	......	......	......	......	20	95	11	50	70.7	......
Horsham	30	73	8	41	57.9	7.81	20	86	4	53	67.9	7.57
Plymouth Meet'g	27, 30	74	8	43	57.0	......	20	88	4, 5	54	68.8	......
Dyberry	27	78	12	34	52.4	......	19, 20	89	2, 3, 13	44	64.5	......
Lehigh Univer'y	27	74	8	41	55.9	......	20	88	3	50	68.1	......
Whitehall	27	82	12	36	57.0	......	18, 20	87	3	44	68.0	......
Factoryville	27	80	8	37	54.5	5.85	20	91	3	45	65.9	2.75
Reading	26	81	8	43	59.0	......	20	92	3	51	71.1	......
Parkesville	30	79	1, 9	45	57.1	4.82	20	92	11	52	67.3	4.68
West Chester	......	......	......	......	......	......	20	92	3	54	71.3	4.15
Ephrata	30	78	4	45	63.4	3.67	19	94	3	50	72.5	1.90
Mount Joy	30	76	9	42	59.0	......	20	92	3, 4, 5, 11	57	70.8	......
Harrisburg	27	77	8	45	59.2	4.40	19, 20	91	3, 4, 5	58	72.9	3.40
Fountain Dale	27	78	8	44	59.9	7.83	19	92	3	55	70.4	3.92
Tioga	29, 30	80	9	30	51.1	5.76	18	101	10	44	68.1	3.17
Lewisburg	27	77	8	40	56.3	4.10	19	91	3, 9	52	68.8	2.71
Ickesburg	30	80	4	42	58.3	5.84	18	93	2, 3	52	69.2	1.92
Grampian Hills	26	77	8, 9	30	52.5	5.91	14, 18	88	3	44	63.9	2.75
Johnstown	29	70	9	28	53.5	12.18	15	86	10	42	64.6	3.40

Meteorology of 1868—Continued.

Stations in States and Territories.	MAY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	JUNE. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
PENNA.—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Franklin	26	79	10	35	56. 6	......	15	92	10	50	68. 5	......
Connellsville	29	82	8	38	58. 8	......	29	90	10	47	69. 6	......
New Castle	29	81	11	32	58. 8	......	15	90	10	39	69. 4	......
Beaver	29	81	7, 8	42	58. 5	4. 15	15, 19, 30	87	9	50	69. 5	1. 50
Canonsburg	29	80	8	40	59. 0	3. 16	15	89	10	43	69. 2	0. 85
Averages	....	......	....	......	57. 0	6. 11	....	......	....	......	68. 8	3. 47
MARYLAND.												
Woodlawn	30	78	3, 8	44	58. 3	5. 02	20	91	3, 4, 11	56	70. 5	2. 37
Annapolis	27	75	8	47	59. 4	8. 14	20	90	4, 5, 11	59	70. 3	3. 37
Emmittsburg	31	80	8	44	59. 5	......	18, 19, 20	90	11	56	71. 1	......
Mt. St. Mary's Col.	27	74	8	45	57. 4	7. 60	18, 19	86	3, 11	53	68. 1	4. 65
Averages	....	......	....	......	58. 7	6. 92	....	......	....	......	70. 0-	3. 46
VIRGINIA.												
Surry Court House	27, 29, 30	89	8	49	68. 5	......	20	93	1, 11	62	75. 3	......
Johnsontown	2	80	8	49	62. 6	......	20	89	3, 4, 10	60	71. 7	......
Comorn	26	78	3	48	61. 9	4. 17	20	91	4, 10, 11	60	70. 8	3. 02
Mount Solon	1	82	12	46	62. 9	5. 22	19	89	11	57	71. 3	2. 43
Lynchburg	....	......	....	......	......	......	19	85	11	58	......	......
Snowville	2, 27	84	10	39	59. 5	12. 30	20, 29	86	12, 13	48	67. 0	1. 21
Wytheville	1	81	10	44	59. 3	3. 80	29	82	12	48	65. 8	2. 50
Averages	....	......	....	......	62. 5	6. 37	....	......	....	......	70. 3	2. 29
WEST VIRGINIA.												
Romney	1, 6	80	9, 11	46	61. 1	......	19	94	....	......	......	......
White Day	29	90	11	40	64. 8	......	4, 5, 18, 19, 29	90	10	50	73. 5	......
Weston	4	84	20	39	62. 3	......	15	93	12	55	71. 5	......
Cabell Court House	1, 29	72	21, 24	39	56. 0	4. 60	....	......	....	......	......	......
Averages	....	......	....	......	61. 1	4. 60	....	......	....	......	72. 5	......
NORTH CAROLINA.												
Kenansville	3	94	4	60	73. 0	3. 98	17, 19, 20	96	11	62	78. 3	7. 38
Goldsboro'	2, 29	92	9	54	69. 5	4. 22	21	96	11	62	76. 5	4. 15
Raleigh	29	94	9	59	58. 1	3. 20	20	98	11	59	75. 9	1. 95
Oxford	2	86	9	52	66. 0	4. 65	19, 20	88	4, 10, 11	58	73. 0	3. 90
Albemarle	2, 29	96	9, 10	42	65. 8	4. 31	30	98	1, 12, 13	54	73. 3	2. 26
Statesville	1, 27, 28, 29	86	9, 10, 14	42	62. 9	3. 12	29	90	12	50	70. 3	1. 25
Asheville	27	82	9	42	62. 3	......	19	86	27	57	68. 9	......
Averages	....	......	....	......	65. 4	3. 91	....	......	....	......	73. 7	3. 48
SOUTH CAROLINA.												
Aiken	1, 5, 27, 28	87	9	56	69. 8	6. 42	17, 20	92	1	63	74. 1	2. 46
Gowdysville	31	89	14	50	68. 8	......	6	89	4, 10	62	74. 7	......
Averages	....	......	....	......	69. 3	6. 42	....	......	....	......	74. 4	2. 46
GEORGIA.												
Atlanta	5	89	9	46	66. 3	4. 26	19	90	23	58	72. 6	0. 50
Macon	1	91	9	53	71. 7	......	....	......	....	......	......	......
Summerville	2	89	13, 14	58	73. 3	5. 83	18, 19	94	10	67	78. 4	1. 18
Penfield	1	87	9	50	69. 6	4. 50	19	94	23	60	76. 8	0. 30
Averages	....	......	....	......	70. 2	4. 86	....	......	....	......	75. 9	0. 66

Meteorology of 1868—Continued.

Stations in States and Territories.	May. Date.	May. Maximum temperature.	May. Date.	May. Minimum temperature.	May. Mean temperature.	May. Rain-fall.	June. Date.	June. Maximum temperature.	June. Date.	June. Minimum temperature.	June. Mean temperature.	June. Rain-fall.
ALABAMA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Opelika	28	93	13, 14	55	71.2	3.00	13	97	22	67	80.4	0.25
Carlowville	23, 31	92	9	56	73.3	0.80	2	96	26	70	81.2	2.70
Moulton	27, 28	82	9	44	66.0	3.48	19	91	23	54	75.0	0.45
Greene Springs	28	89	9	51	68.7	4.40	29	94	9, 23	60	78.4	0.88
Havana	28	88	9	50	68.8	3.89	18, 29, 30	92	23	63	76.7	0.67
Averages	......	......	......	......	69.6	3.11	......	......	......	......	73.3	0.99
FLORIDA.												
Jacksonville	6	97	9, 14, 19	67	78.3	2.85	18	98	9, 10, 11	70	79.8	12.40
Port Orange	6	94	13, 14	68	78.7	......	......	......	......	......	......	......
Lake City	28	92	9	58	72.1	3.13	......	......	......	......	......	......
Averages	......	......	......	......	76.4	2.99	......	......	......	......	79.8	12.40
TEXAS.												
Gilman	31	98	7	60	73.8	1.78	6	98	9	65	80.4	4.03
Houston	26, 27, 31	83	13	66	74.1	......	13, 14	85	4, 6, 8, 9, 10, 15, 20, 22, 23, 24, 25, 27, 29, 30	74	77.3	......
Columbia	29	94	13	57	76.6	2.31	8, 16	96	10	71	81.0	2.40
Waco	29	93	13	56	76.8	3.70	......	......	......	......	......	......
Austin	3, 16, 31	90	11	60	75.2	2.33	18, 19	95	24	72	82.5	0.69
Averages	......	......	......	......	75.3	2.53	......	......	......	......	80.3	2.37
LOUISIANA.												
New Orleans	......	......	......	......	......	......	11, 12, 29	92	22, 25	79	......	......
Benton	27	90	9	58	69.8	1.00	3, 12, 19	91	22	68	81.4	......
MISSISSIPPI.												
Grenada	......	......	......	......	......	......	15, 29	92	22	57	77.6	......
Brookhaven	25, 26	89	8	54	74.1	......	29	98	23	64	79.4	......
Natchez	30, 31	85	8, 9, 13	56	73.8	3.98	15, 30	88	12	67	78.8	1.57
Averages	......	......	......	......	74.0	3.98	......	......	......	......	78.6	1.57
ARKANSAS.												
Helena	28	94	8	52	71.0	......	......	......	......	......	......	......
TENNESSEE.												
Elizabethton	3	86	9	36	61.8	......	14, 16, 29	92	11, 12	52	70.9	......
Tusculum College	27	87	14	45	64.5	......	12, 13, 16, 28	95	1, 12	59	73.1	......
Lookout Mountain	27	89	14	49	69.2	......	19	92	21	56	72.3	......
Austin	28	92	10, 18	50	67.0	2.85	16, 17, 18, 29	94	22, 24	56	75.5	1.20
Clarksville	28	86	8, 14	51	65.3	3.21	19	91	22	58	71.9	1.92
Memphis	28	95	8	53	71.4	3.45	19	97	22, 23	64	79.1	1.53
Averages	......	......	......	......	66.5	3.17	......	......	......	......	73.8	1.55
KENTUCKY.												
Pine Grove	5	84	8	42	60.0	6.14	15	92	10	48	70.0	6.34
Lexington	1, 28	80	8	43	62.0	5.99	15	87	10	50	70.7	6.13

Meteorology of 1868—Continued.

Stations in States and Territories.	MAY.						JUNE.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
KENTUCKY—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Danville	1	88	13	52	66.7	4.50	....	......	....			......
Louisville	26, 28	85	22	45	63.0	8.45	15	93	10, 11, 12	50	71.0	5.98
Clinton	28, 31	87	22	56	68.0	2.78	16,18,19	92	22, 23	59	74.5	1.70
Averages	....	......	....	......	63.9	5.55	....	......	....	......	71.6	5.04
OHIO.												
New Lisbon	26, 28	85	11	36	57.3	4.53	18	94	9	50	69.8	1.81
Steubenville	26	80	8	44	61.0	......	....	......	....	......	......	......
Milnersville	24	85	8	36	58.3	3.24	29	91	12	43	69.6	1.73
Cleveland	26	82	7	41	54.5	4.64	15	92	9	45	66.1	5.48
Wooster	26	85	7	42	62.3	......	18, 19	92	9	50	71.9	......
Gallipolis	....	......	....	......	......	......	19	90	10	52	68.2	2.65
Kelley's Island	26	78	7	43	55.9	2.86	18	89	7	52	68.2	5.98
Sandusky	26	78	1	44	56.4	6.11	19	87	10	51	68.5	13.47
Norwalk	4	84	7	40	55.9	3.62	19	90	7	50	66.9	3.82
North Fairfield	26	81	7	39	57.9	3.77	19	87	10, 11	45	73.9	2.68
Westerville	3, 4	80	7	40	57.6	6.10	19	91	9	50	......	......
Marion	4	79	7, 8	42	57.3	4.54	19	89	7, 9	51	67.8	3.14
Hillsboro'	5, 26	78	7, 8	42	59.4	5.30	15	87	10	49	69.0	4.20
Toledo	26	80	8	40	58.0	5.31	18	91	7	50	68.1	8.19
Bowling Green	5	88	1, 8	45	58.8	6.22	5,14,30	93	10	53	70.6	5.76
Kenton	26	81	14	38	57.3	9.00	30	94	11	45	69.0	7.41
Urbana Univ'ty	26	83	8	42	60.2	6.19	14,15,19	88	9	54	69.6	10.38
Bethel	4	82	18	40	56.8	6.60	15	92	9	50	67.8	3.50
Cincinnati (H.)	4	80	7	45	61.4	6.09	29	89	10	45	71.2	5.60
Do. (P.)	1	86	19	50	66.0	6.01	14	92	10	58	74.6	7.26
College Hill	1, 4, 28	80	8	43	63.2	8.00	15	91	10	50	70.6	7.13
Averages	....	......	....	......	58.8	5.45	....	......	....	......	69.5	5.56
MICHIGAN.												
Monroe City	26	76	1, 7, 18	44	55.2	4.19	14	90	23	40	69.2	7.92
Litchfield	4	84	7	38	56.7	5.15	30	92	9	48	68.4	5.23
Grand Rapids	26	88	1	42	60.2	......	30	96	2, 21	54	70.3	......
Northport	25, 26	82	1	35	52.1	1.00	29, 30	85	6, 8	40	61.4	......
Holland	25	79	1, 7, 13, 16	44	55.4	3.05	14	90	9	48	66.4	2.61
Otsego	25	84	9	37	58.0	......	14, 30	84	9,10,22	42	53.9	......
Copper Falls	26	82	1	32	51.2	1.70	17	82	5	32	57.0	2.10
Ontonagon	25	88	9	32	48.0	......	30	84	1	38	59.5	......
Averages	....	......	....	......	54.6	3.02	....	......	....	......	63.3	4.47
INDIANA.												
Richmond	28	78	7	43	58.9	7.18	30	88	21, 22	54	68.7	3.46
Aurora	....	......	....	......	......	......	15	96	10	52	74.7	2.05
Vevay	1	95	8, 9, 14	49	67.6	5.93	28	97	10, 22	60	76.9	4.95
Muncie	28	85	7	41	61.0	8.75	30	93	10	47	70.5	4.30
Spiceland	25	83	7	44	60.7	7.90	15, 30	91	21	50	71.0	5.00
Columbia City	25	86	6, 7, 8	32	57.2	5.25	16	94	21	52	73.6	6.50
Jalapa	....	......	....	......	......	......	18	93	10	52	67.4	2.13
Carthage	25, 26, 28, 31	78	10	34	59.6	11.75	....	......	....	......	......	......
Indianapolis	5	82	7	44	60.2	8.26	15	90	9, 10	54	67.4	2.09
State University	28	81	8	47	61.4	5.20	17	90	7, 21, 22	57	71.6	2.91
Rensselaer	5	83	5	42	59.0	13.90	17, 18, 19, 30	94	6, 21	48	70.6	1.75
Merom	28	84	8	47	64.1	4.44	30	94	7	54	74.2	3.00
New Harmony	5	86	8,13,14	52	66.6	3.55	17	94	7, 21	60	75.2	1.79
Averages	....	......	....	......	61.5	7.46	....	......	....	......	71.8	3.33

Meteorology of 1868—Continued.

Stations in States and Territories.	May. Date.	May. Maximum temperature.	May. Date.	May. Minimum temperature.	May. Mean temperature.	May. Rain-fall.	June. Date.	June. Maximum temperature.	June. Date.	June. Minimum temperature.	June. Mean temperature.	June. Rain-fall.
ILLINOIS.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Chicago	25	75	13	43	55.3	2.73	30	90	21	50	66.3	3.11
Near Chicago	4	86	13	36	55.6	......	14	102	21, 22	46	67.3	......
Ridge Farm	5	80	8	40	61.0	10.30	17, 18	94	6, 7, 11	52	70.8	2.40
Marengo	4	79	10	34	56.2	4.21	30	92	6	46	......	9.17
Golconda	30	94	9, 21	56	70.3	3.20	16	104	24	56	78.7	1.30
Aurora	25	79	7	42	56.2	3.38	18, 30	90	8	47	70.3	3.00
Sandwich	25	82	1	43	58.6	2.90	14, 30	96	8	48	70.4	1.47
Belvidere	24, 25	81	19	31	56.2	......	30	90	8, 9	50	67.0	......
Ottawa	25	86	7	45	51.9	7.69	29, 30	99	6, 8	51	70.0	......
Winnebago	4	84	1	41	58.7	3.82	30	92	6	50	67.8	5.12
Rochelle	5	84	8, 10	41	58.0	......	14, 30	93	8	50	68.5	......
Wyanet	......	......	......	......	......	......	17	93	22	47	70.3	2.41
Tiskilwa	4	85	12	42	59.6	4.50	17	99	22	48	69.1	......
Hennepin	......	......	......	......	......	......	17	95	22	44	68.0	......
Magnolia	24	88	19	42	60.6	7.80	17	98	22	42	70.5	3.70
Elmira	25	86	7	44	61.3	7.04	16, 17	94	21	52	71.8	2.10
Peoria	25	82	8	47	62.1	7.85	18	97	21	55	72.7	1.43
Springfield	2, 27, 30, 31	86	12, 13	40	61.1	......	30	94	22	52	70.4	......
Dubois	30	83	8	40	61.4	4.75	18	92	8	42	68.0	3.23
Waterloo	30	92	7	51	65.6	......	17	98	22	56	78.0	......
South Pass	......	......	......	......	......	......	16, 19	97	22	55	75.5	......
Galesburg	25	81	7	46	60.5	6.74	18	92	9	56	71.0	1.22
Manchester	29	86	7	48	64.7	5.59	18, 30	93	9	55	73.1	3.22
Mount Sterling	31	88	7, 8	46	66.0	......	27	97	21	54	75.6	......
Andalusia	4, 25	84	19	42	62.1	......	30	95	22	48	70.4	......
Augusta	25	80	7	48	64.6	7.03	18, 30	85	9	57	74.3	2.04
Averages	......	......	......	......	60.3	5.60	......	......	......	......	71.1	1.80
WISCONSIN.												
Manitowoc	21	75	1	36	53.7	1.01	18	85	8	43	62.7	7.20
Plymouth	4, 24, 25	84	1	36	56.0	1.20	30	93	6	42	65.0	5.90
Milwaukee	22	56	1	35	51.5	2.05	18, 29	90	7	39	62.4	5.78
Appleton	23	79	1	36	58.5	......	......	......	......	......	......	......
Geneva	25	82	1	40	57.3	......	30	95	9	46	67.4	3.62
Waupacca	5, 24, 25	85	1	36	59.8	......	30	95	1, 2, 3	45	68.9	......
Embarrass	24	86	1, 11	36	56.3	1.74	30	90	1	47	66.9	3.75
Rocky Run	4, 25	83	1	38	58.4	1.66	30	90	1	50	67.7	3.56
Edgerton	26	90	8	38	59.1	3.34	30	100	3	49	68.4	11.33
Baraboo	24	86	8, 12	31	57.5	5.00	30	96	3	48	68.7	4.13
New Lisbon	24	92	1	37	61.0	......	30	96	9	48	69.4	......
Bayfield	23	80	7	32	48.2	......	30	98	8	42	61.2	......
Averages	......	......	......	......	56.4	2.29	......	......	......	......	66.2	5.66
MINNESOTA.												
Beaver Bay	27	73	10	31	47.9	0.80	30	79	3	41	58.2	1.86
St. Paul	24	87	28	39	60.4	3.96	30	94	8	48	67.6	2.68
Minneapolis	24	91	28	38	59.6	4.37	28	96	8	47	68.0	4.23
Sibley	24	85	12	43	60.0	3.80	17	92	9	43	68.2	4.34
Danville	......	......	......	......	......	......	30	92	8, 20	48	67.8	......
New Ulm	24	84	8, 28	46	61.7	3.68	30	95	8, 21	52	70.1	2.50
Averages	......	......	......	......	57.9	3.32	......	......	......	......	66.7	3.12
IOWA.												
Clinton	22, 24	82	7, 8	40	60.2	10.00	16, 30	95	22	52	70.9	5.60
Davenport	4, 25	80	7	45	59.8	13.04	30	90	3	54	70.2	4.85
Dubuque	25	82	1, 8, 13	46	60.7	3.53	30	95	3, 9, 20, 21	54	69.4	6.03
Monticello	26	90	13, 19	47	61.2	4.59	16, 17	91	22	53	69.6	3.75
Bowen's Prairie	23	88	30	44	61.7	5.09	16	92	7	51	69.2	4.17
Burlington	25	84	7	46	63.2	......	......	......	......	......	......	......
Fort Madison	31	86	19	41	62.0	9.84	14	93	21	53	72.9	2.13
Guttenberg	25	89	19	42	59.1	......	30	98	9	44	66.3	......

Meteorology of 1868—Continued.

Stations in States and Territories.	MAY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	JUNE. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
IOWA—Con.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Ceres	4	86	6	40	62.9	......	......	......	......	......	......	......
Mt. Vernon	25	85	19	40	62.3	......	14	96	6, 20	53	70.5	......
Iowa City	21	82	13	46	61.6	7.20	17, 18	92	22	47	70.8	1.28
Independence	23	89	7	45	61.5	3.60	30	95	21	53	70.1	2.90
N'r Independence	24	88	12	43	56.8	5.70	17	100	21	47	74.9	4.10
Waterloo	24, 25	86	29	46	67.0	......	30	96	20, 21	50	67.4	......
Iowa Falls	24, 25	84	5, 8	36	63.5	3.28	30	90	21, 22	54	71.2	8.67
Algona	24	86	7	44	60.6	......	16, 30	92	20	48	69.0	......
Near Algona	23	82	7, 29	44	60.9	......	30	90	21	47	67.3	......
Fort Dodge	24, 25	88	7	44	61.3	5.02	30	98	21	51	71.2	4.14
Boonesboro'	27	87	12	44	62.5	6.58	13, 17	95	20, 21	50	67.0	2.77
Rolfe	23	89	6, 7	42	62.6	4.47	30	95	20	50	71.4	4.96
Fontanelle	25	87	7, 11	47	64.7	6.36	30	96	8, 20, 21	54	72.8	7.50
Logan	5	84	12	40	60.9	4.00	17	90	21	45	68.2	6.90
Woodbine	23	88	30	44	61.7	5.09	16	92	7	51	69.2	4.17
Averages	......	......	......	......	61.7	6.09	......	......	......	......	70.4	4.62
MISSOURI.												
St. Louis Univ	5	87	7, 13	51	66.9	4.00	17	95	21	57	74.5	1.46
Allenton	1, 25	90	19, 22	40	65.1	5.71	17	101	11	50	71.9	1.67
Hematite	1, 2	88	22	42	66.1	7.70	18	96	10	47	73.6	4.80
Canton	3, 31	87	7	47	64.7	6.05	30	95	22	44	72.2	2.32
Rolla	1	87	8	39	64.1	3.39	17	93	22	44	70.3	3.25
Jefferson City	3	86	7	50	65.0	......	17, 18	94	22	56	74.0	......
Hermitage	2	92	13	45	67.0	1.29	30	99	21	51	75.8	1.47
Harrisonville	2	88	7	46	66.3	4.23	16, 17, 18, 30	94	6, 9, 20	58	74.1	3.93
Oregon	2	88	12	50	66.7	3.50	30	96	9	55	73.9	3.51
Averages	......	......	......	......	65.8	4.48	......	......	......	......	73.4	2.80
KANSAS.												
Atchison	2	92	12	46	66.7	9.45	18	100	23	53	74.7	5.40
Leavenworth	2	94	22	42	64.6	4.35	18	102	22	42	73.1	4.25
Olathe	2	97	30	38	62.3	4.90	28, 29	98	20	55	74.8	5.80
Baxter Springs	27	96	8	46	71.4	2.95	28	103	21	56	80.3	0.90
Lawrence	2	91	7	46	66.7	2.81	18	99	6	57	75.1	3.80
Holton	1, 2, 4, 24, 31	89	11	46	70.1	......	18	102	9, 20	56	77.4	......
State Agr. College	2	88	12	51	67.0	1.38	16	97	21	53	74.3	3.48
Council Grove	2, 5, 9	90	12	46	70.8	3.05	18	99	22	54	77.7	2.90
Averages	......	......	......	......	67.5	4.13	......	......	......	......	75.9	3.93
NEBRASKA.												
Dakota	31	90	11	45	64.6	......	......	......	......	......	......	......
Omaha Mission	5	84	7	45	65.5	......	30	92	10	50	72.7	2.25
Elkhorn	25	83	6	45	64.6	......	18	93	9	54	71.2	......
De Soto	1	85	6	45	65.1	......	30	93	9	51	72.2	4.13
Bellevue	1, 3, 5	86	6	48	65.0	7.20	27	94	9	54	74.6	......
Glendale	1	89	8, 11	45	65.0	8.20	18, 30	92	9	51	72.0	5.00
Averages	......	......	......	......	65.0	7.70	......	......	......	......	72.5	3.79
UTAH.												
G't Salt Lake City	13	73	7	41	56.3	2.36	22	90	4	45	66.3	4.00
Wanship	......	......	......	......	......	......	30	95	24, 25	44	63.1	......
Averages	......	......	......	......	56.3	2.36	......	......	......	......	64.7	4.00
CALIFORNIA.												
San Francisco	11	83	3	49	56.4	0.13	25	71	18, 19	50	56.1	0.33

Meteorology of 1868—Continued.

Stations in States and Territories.	MAY.						JUNE.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
CALIFORNIA—Con.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Monterey	.9	69	3, 4	47	57.4	0.11	16	72	2	48	59.5	0.72
Antioch	11	88	3	45	6.27	0.56	......	......	......	......	......	......
Murphy's	12	92	5	30	56.0	......	27	94	1	34	63.3	0.02
Averages	......	......	......	......	58.1	0.27	......	......	......	......	50.6	0.23
WASHINGTON.												
Port Townsend	22	75	2, 8	42	55.1	0.63	19	82	9	50	59.5	2.62

	JULY.						AUGUST.					
MAINE.												
Steuben	4	81	23	52	63.0	2.40	24	81	27, 28	50	64.9	3.80
West Waterville	5	96	25	59	71.9	3.15	2, 3, 25	86	28	52	68.8	0.96
Gardiner	5	90	23	58	69.3	1.87	3	82	28	53	67.5	1.06
Standish	14	97	23	54	73.0	3.70	2	89	13	52	......	......
Norway	3, 4, 5, 12, 15	94	6, 26	58	72.1	......	3	88	12, 28	54	67.6	......
Cornish	15	99	6	56	72.8	2.90	26	85	17, 18, 28	53	67.5	2.30
Cornishville	15	97	6	58	74.1	2.80	2, 3	84	12, 13, 14, 27	56	69.0	3.18
Averages	......	......	......	......	70.9	2.80	......	......	......	......	67.6	2.25
NEW HAMPSHIRE.												
Portsmouth	15	102	6	58	72.0	......	......	......	......	......	......	......
Stratford	13	100	23	54	73.4	3.05	2	86	17	46	64.8	2.42
Shelburne	......	......	......	......	......	......	2	93	18	42	......	......
Goffstown Center	15	104	1	63	75.4	2.40	3	92	17	56	72.8	3.20
Claremont	13, 15	96	27	59	75.0	1.85	19	86	13	46	67.1	5.93
Averages	......	......	......	......	74.0	2.43	......	......	......	......	68.2	3.85
VERMONT.												
Lunenburg	3, 13, 15	95	23	53	72.1	4.63	3	85	17, 28	49	67.2	1.81
North Craftsbury	14	101	25, 26	56	73.2	1.42	2, 26	84	17	44	64.8	2.20
Randolph	13	102	26, 28	57	74.7	1.97	3	89	17	43	66.4	3.56
Woodstock	13	94	27	52	71.8	......	26	82	17, 18	47	64.2	......
Near St. Albans	14	95	27	58	75.8	......	25, 26	83	17	49	67.7	......
West Charlotte	14, 15	107	27	64	80.0	2.13	2	94	17	54	73.4	4.63
Middlebury	5	90	26	57	73.5	1.91	2	79	17	48	66.4	2.17
Averages	......	......	......	......	74.4	2.41	......	......	......	......	67.2	2.87
MASSACHUSETTS.												
Kingston	5	102	7, 29	60	72.8	1.87	30	91	28	51	70.7	3.75
Topsfield	15	97	6	55	73.1	0.41	1, 3	88	27	53	69.2	3.09
Lawrence	15	96	6	58	72.0	1.41	30	85	28	47	69.3	4.45
Georgetown	12	97	6	54	75.2	0.70	2	92	28	53	70.8	3.75
Newbury	15	103	6	56	73.8	......	......	......	......	......	......	......
Milton	5	98	6, 7	55	71.7	1.11	3	90	28	46	66.5	4.25
Cambridge	12	101	6	60	75.3	......	3, 29	93	27	51	72.0	......
North Billerica	15	97	6	56	74.2	......	3	87	17, 28	48	70.6	......
West Newton	5	105	25	60	78.8	1.26	......	......	......	......	......	......
New Bedford	5, 12	92	9, 10	61	71.2	3.66	1, 3, 30	82	17, 28	56	69.1	4.29
Worcester	15	92	6	60	74.0	1.08	3	83	28	51	68.9	3.57
Mendon	5, 12	92	6	58	73.1	1.20	3	85	27, 28	49	68.4	5.20
Lunenburg	15	98	7	59	75.1	1.90	3	87	17	53	69.6	3.30
Amherst	15	95	27	57	74.0	3.28	3	85	13	51	69.0	5.67
Richmond	14	98	9	62	78.5	2.82	2	90	25	56	73.6	7.10

Meteorology of 1868—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
MASS.—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Williams College	15	94	27	55	74.7	0.37	2, 3	84	17	48	67.9	3.40
Hinsdale	14	93	6	60	74.3	......	2	85	12	50	67.3	4.25
Averages	......	......	......	......	74.2	1.62	......	......	......	......	69.5	4.31
RHODE ISLAND.												
Newport	12, 14	86	1, 2, 10	59	69.7	2.99	10, 14, 24	82	28	53	67.9	2.71
CONNECTICUT.												
Pomfret	5, 13	89	7	58	68.2	1.35	1, 3, 30	82	28	53	67.5	5.63
Columbia	11	98	6	58	76.1	......	30	92	28	52	72.0	......
Middletown	13	95	7	61	74.1	2.35	30	87	28	56	70.8	7.38
Colebrook	13	94	7	61	74.7	......	2, 30	84	13, 17	52	68.6	......
Waterbury	13, 15	92	27, 29	61	74.1	2.86	30	86	13	53	69.2	6.71
Averages	......	......	......	......	73.4	2.19	......	......	......	......	69.6	6.57
NEW YORK.												
Moriches	13	105	29	66	78.1	5.92	22	93	13	62	75.3	4.07
South Hartford	14	98	9	67	79.7	0.80	21	86	17	47	72.6	1.84
Troy	15	100	27	64	79.4	2.35	2, 19	87	17	54	71.3	3.85
Garrison's	5	96	26, 28, 29	66	77.4	1.63	30	87	13	57	71.3	6.23
Throg's Neck	5	95	28	66	76.5	......	4	89	14	60	76.9	......
White Plains	13, 15	90	27	65	72.8	......	1, 2	85	12	57	71.6	......
Deaf & Dumb In'n	5, 13, 15	92	7	65	76.2	6.44	3	88	13, 17	60	72.9	8.31
Columbia College	5, 15	95	7	64	77.4	4.72	30	88	17	61	74.3	5.25
Flat Bush	13, 15	94	24	62	77.2	5.27	20	89	12, 27	61	73.2	2,90
Newburgh	15	97	1, 7	68	78.3	1.62	19	78	17	62	73.3	5.88
Minaville	14	100	27	61	79.0	1.10	19	89	17	50	72.5	2.89
Gouverneur	14	98	22	57	75.7	1.91	26	84	12	52	66.9	1.25
North Hammond	2, 15	100	26	63	80.4	1.00	28	96	16, 17	56	72.3	1.55
Houseville	13	95	25	60	76.1	4.35	2, 25, 26	82	16	47	67.1	4.88
Cazenovia	2	93	26	62	76.0	......	26	84	17	47	67.4	......
Oneida	14	97	26	60	77.3	5.97	2	87	16	51	69.0	6.60
Depauville	14	95	26	60	76.5	1.00	7	87	17	45	68.1	3.43
Oswego	4	90	26, 27	61	72.9	1.93	28, 29, 31	82	17	49	67.4	3.1[illegible]
Palermo	14	99	5	57	79.1	0.70	25, 29	87	17	48	69.2	2.7[illegible]
North Volney	4, 14	96	26	61	77.2	......	29	86	17	49	68.7	......
Nichols	14	101	26, 27	59	77.5	......	2, 26	92	17	52	70.2	......
Newark Valley	14, 15	98	26	56	77.2	4.25	2, 22, 26	86	13	46	66.9	......
Geneva	15	95	1	67	79.3	0.85	29	93	24	56	73.9	1.29
Rochester	13, 14	93	26	61	76.9	0.68	28, 29	86	17	56	69.8	3.22
Little Genesee	14	98	27	53	74.7	1.90	7, 23, 26, 31	84	12, 13	50	67.8	1.65
Suspension Bridge	12, 13	102	17	62	77.3	0.50	26	92	13	53	69.3	2.50
Buffalo	17	98	26	63	78.5	3.11	29	92	13, 16	55	70.8	2.43
Averages	......	......	......	......	77.2	2.64	......	......	......	......	70.7	3.61
NEW JERSEY.												
Paterson	15	98	7, 29	65	77.8	7.30	3	93	13	56	73.3	4.15
Newark	13	92	1	61	75.7	8.54	30	87	13	56	72.2	4.99
New Brunswick	5. 15	96	27	66	77.4	5.04	19	89	17	59	73.0	3.15
Trenton	13	95	28	70	82.3	4.10	1, 3	88	13	60	74.8	3.91
Moorestown	14	98	27, 28	66	78.4	3.60	1, 30	88	17	61	73.2	3.67
Elwood	2	96	11, 29	62	80.2	......	31	90	13	55	75.5	......
Rio Grande	14	102	27, 28	62	79.4	9.88	30	95	13	59	73.8	......
Dover	15	98	28	64	75.9	4.16	30	87	13	57	71.9	4.04
Haddonfield	......	......	......	......	......	......	3	89	14	60	72.4	3.32
Newfield	15	101	27, 28	65	79.1	......	1	95	13	58	75.0	......
Greenwich	14	95	27	65	78.7	2.68	1, 30	86	14	59	74.2	3.83
Vineland	14	106	27	64	82.6	3.00	31	95	12, 13	60	76.4	6.02
Averages	......	......	......	......	78.9	5.37	......	......	......	......	73.8	4.12

Meteorology of 1868—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
PENNSYLVANIA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Nyces	13, 14	95	26	58	75.2	3.75	30	85	13	48	69.5	5.60
Fallsington	13, 14	95	27	68	78.0	3.80	30	90	12, 13, 28	63	74.0	5.60
Philadelphia	14	97	27	68	81.6	2.63	30	88	17	65	77.5	2.55
Germantown	14, 15	98	27	64	81.5	......	20, 21	94	{ 5. 14. 1, 3, 30 }	60	73.6	......
Horsham	14, 15	92	27, 29	65	76.9	3.58	31	87	13, 17	59	72.4	4.82
Plymouth Meet'g.	14	95	27	67	78.4	......	30	88	13, 17	60	73.7	......
Dyberry	14	97	27	56	73.8	......	19	84	17	46	66.0	......
Lehigh Univer'y.	14, 15	95	28	64	77.0	......	1	87	17	57	71.8	......
White Hall	14, 15	96	28	64	77.7	......	31	88	17	56	72.7	......
Factoryville	14	98	26	58	76.9	1.05	19	87	17	49	69.3	5.30
Reading	15	98	28	67	79.9	......	27, 30	87	13	59	74.4	......
Parkersburg	14	98	27	70	80.5	5.70	30	90	14	60	74.8	4.67
West Chester	14, 15	92	27, 28, 29	67	77.2	4.14	....	......	13	60	72.5	2.71
Ephrata	15	103	29	68	81.5	2.48	....	......	....	......	......	......
Mount Joy	19	103	29	65	80.8	......	30	92	13	54	74.3	......
Harrisburg	14, 15	96	29	70	82.6	2.36	27	87	13, 14	65	76.0	1.70
Fountain Dale	15	96	27	66	77.7	2.67	1	86	13	60	71.2	3.01
Tioga	14	106	26, 28	60	79.3	1.00	7	90	13	50	67.0	3.21
Lewisburg	15	98	29	62	78.4	2.05	2, 19, 30	87	24	53	71.9	3.65
Ickesburg	15	100	29	64	77.8	4.08	26	89	15	55	71.9	1.79
Grampian Hills	14	102	29	58	75.8	3.36	31	85	13, 14	52	68.0	3.57
Johnstown	15	94	29	56	74.0	5.76	2	82	13	46	66.4	2.50
Franklin	4, 15	98	26	57	77.3	......	27	88	13	49	69.1	......
Connellsville	4, 19	98	27	59	79.6	......	18	90	12	52	71.9	......
New Castle	15	98	17, 26	61	80.3	......	27	88	13	44	73.0	......
Beaver	14	94	17, 26	68	82.4	0.25	18	89	13	53	75.6	0.50
Canonsburg	5	97	18, 29	64	78.3	4.08	27	90	13	50	69.0	3.33
Averages	....	......	....	......	78.5	3.10	....	......	....	......	71.8	3.41
MARYLAND.												
Woodlawn	14, 15	100	27	65	79.7	4.78	30	90	13	63	74.6	3.00
Annapolis	15	98	27, 28	69	85.4	2.28	{ 1, 19, 30, 31 }	88	14	62	77.3	7.39
Emmittsburg	15	104	27	65	80.4	......	30	90	13, 14, 15	60	73.4	......
Mt. St. Mary's Coll.	15	95	27, 28, 29	65	76.5	3.05	31	86	14	58	71.5	3.07
Averages	....	......	....	......	80.5	3.37	....	......	....	......	74.2	4.69
VIRGINIA.												
Surry C. H.	16	99	28	70	82.5	......	31	94	13, 14	64	79.0	......
Johnsontown	15	100	28	69	79.8	......	30, 31	90	13	63	76.4	......
Comorn	15	97	28	67	82.2	6.52	31	88	14	65	......	......
Mt. Solon	16	98	28	62	79.0	1.00	26, 31	88	15	57	75.5	3.24
Lynchburg	16	96	27	61	80.1	......	1	84	13, 14	62	75.1	......
Snowville	16, 19	92	2, 5, 8, 28	64	74.1	......	1, 8, 31	83	13	48	69.3	......
Wytheville	16, 17, 18	92	3	61	74.0	6.56	5, 8, 27, 31	82	15	56	69.0	3.37
Averages	....	......	....	......	78.8	4.69	....	......	....	......	74.1	2.29
WEST VIRGINIA.												
Romney	14, 19	98	28	62	79.0	......	18, 31	88	13, 14	56	72.9	......
White Day	3, 4, 5, 6	98	7, 8, 9, 29	70	82.9	......	26	95	13	53	78.4	......
Weston	....	......	....	......	......	......	7, 12, 27	88	14	52	74.7	......
Averages	....	......	....	......	81.0	......	....	......	....	......	75.3	......
NORTH CAROLINA.												
Kenansville	16	105	27	72	82.4	9.53	11	95	{ 4, 5, 6, 18, 20, 22, 24, 25, 27 }	76	82.2	2.72
Goldsboro	16	101	2	72	83.3	9.30	11	96	13	64	79.0	3.25
Raleigh	16	108	28	70	84.5	5.95	18	97	14, 24	63	79.1	7.18

Meteorology of 1868—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
N. CAROLINA—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Oxford	16	100	28	68	81. 0	10. 20	1, 2, 3	90	14, 15	62	76. 3	2. 65
Albermarle	16	99	6	64	79. 1	9. 70	10	94	14	57	75. 6	6. 44
Statesville	16	100	1	64	80. 1	4. 00	1, 2	88	13, 14	56	73. 7	12. 63
Asheville	4	86	9	66	74. 1	......	1,6,7,10	83	13	58	71. 3	......
Averages	....	......	....	......	80. 6	8. 11	....	......	....	......	76. 7	5. 81
SOUTH CAROLINA.												
Aiken	17	99	3, 5, 31	71	79. 4	......	11	90	14	65	76. 2	6. 40
Gowdeysville	16, 17	97	2, 5	72	82. 1	......	2, 11, 17, 31	90	14	65	77. 6	......
Averages	....	......	....	......	80. 8	......	....	......	....	......	76. 9	6. 40
GEORGIA.												
Atlanta	17	98	8, 13, 14	66	77. 8	3. 14	31	90	16	59	71. 2	2. 17
Summerville	17	99	30	74	82. 7	3. 93	....	......	....	......	......	......
Penfield	17	101	1, 2, 3	70	81. 8	3. 46	2	92	24	65	79. 1	5. 45
Averages	....	......	....	......	80. 8	3. 51	....	......	....	......	75. 1	3. 81
ALABAMA.												
Opelika	18	103	29	70	81. 6	6. 28	12, 20	93	14, 16	71	79. 2	3. 28
Carlowville	18	100	29	70	81. 2	5. 70	10, 11	92	13, 23, 24, 28, 29	72	76. 1	3. 13
Moulton	18	92	2, 8, 30, 31	71	78. 2	3. 60	29	84	13, 22, 25	62	74. 2	2. 42
Greene Springs	18	97	9, 12, 25, 27, 28, 30	72	79. 8	5. 33	10, 28	89	23, 24	64	77. 8	3. 72
Havana	17, 18	96	9, 20, 30	71	80. 0	4. 72	11	89	23	66	74. 0	......
Fish River	18	92	7. 16	72	76. 4	8. 00	8, 9, 10	90	23	75	......	......
Averages	....	......	....	......	79. 5	5. 61	....	......	....	......	76. 3	3. 14
FLORIDA.												
Jacksonville	17	101	31	74	82. 8	7. 70	11, 12	97	23	74	83. 6	4. 70
TEXAS.												
Gilmer	20, 21	100	7, 27	74	83. 5	3. 00	15	100	19, 22, 24, 26	73	84. 1	0. 38
Houston	20, 21	84	3,5,14, 30, 31	73	76. 2	8. 35	16, 17	84	2	66	76. 6	......
Columbia	24, 25	95	3	73	82. 5	3. 29	16, 17	98	26	72	82. 2	7. 83
Waco	17	100	7	73	87. 1	1. 40	13	100	20	69	83. 4	2. 30
Austin	28, 29, 30	96	3, 4	72	82. 2	2. 55	2, 14, 15, 16, 17, 18	96	20	71	81. 7	7. 00
Averages	....	......	....	......	82. 3	3. 72	....	......	....	......	81. 6	4. 33
LOUISIANA.												
New Orleans	19	98	28	74	82. 8	......	12	93	24	78	......	......
Benton	16, 17, 18, 19, 20, 21	92	7	74	83. 8	......	2	92	22, 23	72	82. 1	......
Averages	....	......	....	......	83. 3	......	....	......	....	......	82. 1	......
MISSISSIPPI.												
Grenada	19	93	1, 2, 7, 10, 14, 15	70	79. 9	......	10	90	23	60	77. 3	......

Meteorology of 1868—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
MISSISSIPPI—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Brookhaven	16	96	29	70	78.5	......	8, 29	94	24	69	79.4	......
Natchez	19	89	4	72	81.9	9.64	2, 11	88	24	67	81.7	3.62
Averages	......	......	......	......	80.1	9.64	......	......	......	......	79.5	5.62
TENNESSEE.												
Elizabethton	16, 17	96	6	61	77.3	......	27	89	13	52	63.5	......
Tusculum College	17, 18	98	27	67	80.1	2.95	17	90	13	61	74.9	......
Lookout Mountain	17	96	30	70	80.1	......	11	88	13	64	76.5	......
Austin	17	100	1, 2	72	86.6	1.82	10	92	13, 14	62	73.0	4.60
Clarksville	18	94	1	70	79.4	4.41	30	88	13	61	[illegible]	3.62
Memphis	13, 15, 19	101	8	74	84.6	2.74	30	97	22	66	79.1	6.35
Averages	......	......	......	......	81.3	2.98	......	......	......	......	76.7	4.46
KENTUCKY.												
Pine Grove	16	98	5, 28	60	79.6	1.78	6, 17	90	13	56	72.0	6.27
Lexington	14	94	6, 28	67	79.6	2.75	17, 29	86	13	50	[illegible]	5.75
Louisville	16	[illegible]	29	68	81.7	3.16	17	91	11	54	[illegible]	6.03
Clinton	18	93	1	73	82.2	3.05	7, 29	89	22	59	74.2	3.95
Averages	......	......	......	......	80.8	3.17	......	......	......	......	73.3	5.50
OHIO.												
New Lisbon	15	100	26	60	80.3	4.80	3, 17, 25, 27	88	13	52	73.9	2.77
Steubenville	......	......	......	......	......	......	18, 31	86	13	53	76.0	......
Painesville	......	......	......	......	......	......	31	84	12	57	69.4	5.38
Milnersville	4	99	17, 27	67	78.9	2.65	17	89	13	46	71.8	1.53
Cleveland	2, 4, 18	92	28	62	77.7	0.45	8, 31	86	13, 22	56	69.2	4.34
Wooster	14	100	28	68	83.2	......	17, 26, 27	92	13	60	75.0	2.30
Gallipolis	15	98	29	64	79.2	3.65	......	......	......	......	......	......
Kelley's Island	3, 18	92	8, 9	72	81.7	0.53	15	84	12	64	73.0	3.78
Sandusky	18	92	28	68	82.9	0.48	8	83	13	56	70.3	5.23
Norwalk	18	94	26	64	78.1	......	7, 26, 31	84	13	53	68.9	4.24
North Fairfield	15	98	28	66	79.9	1.33	17, 31	87	13	54	71.2	3.58
Westerville	15	98	25, 28, 29	68	......	2.99	27, 31	88	12	53	69.8	4.66
Marion	15	94	26, 27, 28	66	78.5	2.32	17, 27, 31	85	13	54	69.9	2.86
Hillsboro'	16	94	25, 26	68	77.7	2.87	28	83	13, 14	56	68.1	7.34
Toledo	14, 18	100	27	62	79.7	2.50	28	89	10	52	69.8	4.44
Bowling Green	4, 13, 14, 15, 18, 21, 17	99	26	62	83.6	4.98	6	91	12	55	73.0	3.80
Kenton	18	101	27	71	87.3	4.25	6, 20	91	24	64	77.2	4.56
Urbana Univer'y	14, 15	96	28	67	80.5	1.88	16, 17	87	12	56	71.5	5.21
Bethel	17	96	5, 10, 26	68	80.7	4.38	17	90	13	55	72.6	6.13
Jacksonburg	19, 23	96	8	66	80.9	1.50	19	91	15	55	73.4	5.88
Cincinnati (H)	17	99	29	69	82.1	1.21	17, 28	90	13	58	73.0	4.64
Do. (P)	15	102	28	73	85.8	1.70	28	93	13	59	76.4	6.63
College Hill	14, 16	99	5, 6	70	82.0	2.50	1	89	15	60	73.1	5.38
Averages	......	......	......	......	81.0	2.47	......	......	......	......	72.1	4.48
MICHIGAN.												
Monroe City	4, 5, 12, 14, 15, 18	96	26	63	80.9	2.39	15, 20	88	12	52	69.9	2.63
State Agr. College	......	......	......	......	......	......	25	88	10	52	70.1	2.42
Litchfield	13, 14, 17	98	27	61	79.2	2.80	1	85	10	55	65.2	1.38
Cold Water	18	99	27	54	77.5	1.63	28	87	13	48	67.6	2.56
Grand Rapids	1, 2, 4, 11, 18	98	[illegible]	64	81.5	......	17, 27	86	11, 22	54	68.1	......
Northport	14, 17	84	7	58	75.3	0.42	6	86	21	46	66.0	2.25
Holland	18	96	25, 26	61	78.9	0.73	6, 17, 26, 27	86	10, 21	53	67.2	1.63

Meteorology of 1868—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
MICHIGAN—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Otsego	18, 22	89	26	50	67.3	......	23	89	11	46	63.0	......
Copper Falls	11, 16	91	5	51	70.2	0.70	6	79	8	47	60.1	5.40
Ontonagon	16	98	4	56	73.5	......	6, 24	84	20	58	68.3	......
Averages	....	......	....	......	76.0	1.45	....	......	....	......	66.6	2.52
INDIANA.												
Richmond	15	95	5, 26, 27	68	79.3	4.19	17, 28	86	12	57	70.8	3.81
Aurora	4, 14, 16	102	5, 6, 8, 9, 26, 28	72	83.8	3.17	16	94	13	55	74.5	6.53
Vevay	17	99	26, 27	73	84.8	1.17	28	90	13	58	76.3	4.29
Muncie	4, 14, 15, 16	98	26	66	81.5	2.40	17	92	14	55	72.1	4.15
Spiceland	4, 15	98	5, 25	69	81.7	4.00	16	88	12	55	71.8	3.20
Columbia City	12	100	30	66	82.9	3.44	6, 28	90	10	54	70.5	4.06
Jalapa	17	97	26	60	80.3	2.46	7, 17	89	13	47	69.7	3.06
Indianapolis	16, 17	95	26	66	80.8	4.40	28	90	13	55	70.9	2.35
State University	16	94	26	66	81.1	2.38	28	88	10, 12	58	72.4	......
Rensselaer	18	100	25	64	82.0	2.55	17, 27	88	13	54	70.0	1.55
Merom	7	99	25	72	85.3	1.00	28	90	12	65	76.7	3.17
New Harmony	18	99	9, 25	70	84.1	2.42	1	91	12, 21	63	74.9	4.82
Averages	....	......	....	......	82.3	2.81	....	......	....	......	72.6	4.00
ILLINOIS.												
Chicago	4	100	8, 9	70	81.4	2.87	17, 27	88	11, 12	60	73.1	3.55
Near Chicago	4	102	8	66	84.8	......	17	97	20	56	73.0	......
Ridge Farm	7, 13	98	27	66	82.1	1.75	17	92	12	57	70.5	2.40
Marengo	17, 18	100	25	57	79.9	......	6	89	....	......	83.8	5.29
Golconda	19	107	29	68	83.0	2.10	1	99	14, 17	58	75.1	2.60
Aurora	17	95	25	62	77.5	2.28	27	85	22	53	66.1	4.60
Sandwich	1, 12, 14, 30	97	25	57	80.4	3.63	6, 17	89	22	52	67.6	2.29
Belvidere	18	96	26	54	78.6	......	27	90	30	51	67.6	......
Ottawa	18	102	25	60	78.4	1.96	16, 27	94	11, 30	55	71.4	3.19
Winnebago	17, 18	97	26	60	79.1	2.93	27	90	30	46	68.0	1.60
Rochelle	28	100	25	58	80.1	......	27	91	12, 30	52	68.5	......
Wyanet	14	101	26	52	79.1	2.03	27	92	21	49	70.1	2.08
Tiskilwa	4, 18	102	26	62	80.9	......	27	90	21	55	66.7	......
Hennepin	18	98	28	54	79.0	......	27	92	4, 30	52	69.0	......
Magnolia	18	105	25	58	84.8	2.40	26	94	21	47	67.6	2.70
Elmira	17, 28	97	26	65	81.9	1.25	27	90	30	54	68.9	3.38
Peoria	14	99	25, 26	66	83.1	1.47	26	90	21	56	71.5	2.74
Springfield	16, 18	103	2	68	81.7	......	7	93	11	61	72.1	......
Dubois	18	98	9, 28	64	79.5	2.70	2, 6, 27	88	21	46	67.6	2.10
Waterloo	18	103	26	70	88.0	......	6, 7, 16	93	21	60	78.8	......
South Pass	....	......	....	......	......	......	1, 29	93	21	58	76.0	......
Galesburg	18	96	26	72	82.3	1.79	27	87	31	57	68.1	3.51
Manchester	18	100	25	68	84.0	1.70	6, 26, 27	92	12	56	71.9	3.03
Mt. Sterling	17	103	25	70	88.0	......	26, 27	90	30, 31	58	73.8	......
Andalusia	17	100	25	60	82.2	......	6	93	21	50	70.1	......
Augusta	14, 15	94	25	67	84.5	5.24	27	86	29	58	73.2	4.37
Averages	....	......	....	......	81.8	2.41	....	......	....	......	71.2	3.09
WISCONSIN.												
Manitowoc	14	94	7	59	73.6	2.45	1	88	21	53	66.2	1.36
Plymouth	1, 13	97	25	59	78.0	3.00	6	91	11	51	67.0	3.00
Milwaukee	1	96	26	56	74.6	3.73	15	88	30	43	69.0	1.85
Geneva	13, 18	98	24	61	80.2	1.05	27	89	22, 30	55	67.8	0.35
Waupacca	12, 13, 14	97	25	65	79.7	......	26	87	11, 21, 30, 31	55	68.2	......
Embarrass	10	96	26, 28	55	77.4	3.59	6	86	13	48	63.9	3.73
Rocky Run	17	98	26	61	80.4	5.19	6, 27	89	9, 31	54	66.0	2.00
Edgerton	16	102	26, 27	60	80.6	......	5	96	19, 29, 30	50	68.8	......

Meteorology of 1868—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
WISCONSIN—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Baraboo	17	99	25	58	77.7	1.00	25, 26, 27	86	21	48	65.6	......
New Lisbon	12	101	25	60	81.2	......	25	94	29	50	73.3	......
Bayfield	11, 14	96	5	52	72.4	......	23	90	19, 31	52	65.6	......
Averages	......	......	......	......	77.8	2.86	......	......	......	......	67.4	2.40
MINNESOTA.												
Beaver Bay	21	89	6	48	65.1	5.02	23	83	29	52	64.1	3.75
St. Paul	16	97	5, 25, 27	65	78.4	4.07	24	88	30	48	67.1	3.08
Minneapolis	16	101	4, 5, 24, 25, 27	63	78.5	3.09	5	87	31	48	66.1	2.81
Sibley	16	98	24	59	77.5	1.73	24	88	31	41	65.2	2.87
New Ulm	16, 29	96	25	65	80.8	3.62	23	90	29	53	70.5	0.99
Sauk Center	10	97	27	58	75.5	5.72	15	85	30	48	66.5	5.44
Averages	......	......	......	......	76.0	3.88	......	......	......	......	66.6	3.14
IOWA.												
Clinton	13, 14	98	26	62	83.8	3.60	15, 24, 26, 27	90	12	56	71.7	1.59
Davenport	17, 18	95	26	59	81.1	5.43	26	86	12	55	68.8	3.68
Dubuque	17	97	26	59	81.3	3.67	27	90	30	50	68.9	2.35
Monticello	17	96	26	60	80.2	2.90	26	88	29	50	65.1	1.70
Bowen's Prairie	20	94	25, 26	66	79.1	2.45	26	80	30	50	67.6	2.65
Ft. Madison	18	103	26	64	84.2	4.85	15, 17, 26, 27	88	30	53	70.3	3.34
Guttenberg	11, 17, 19, 20	96	26	56	77.1	......	27	89	21, 30	44	64.2	......
Mt. Vernon	13, 14, 17	99	26	63	80.9	......	26	91	21, 29	51	67.7	......
Iowa City	14, 28	96	26	53	80.8	6.15	24	92	12, 21	48	69.1	4.67
Independence	17, 20	101	24	66	82.3	3.10	26	97	30	48	68.9	1.90
N'r Independence	17	105	25	60	83.5	4.80	25, 27	93	29	46	68.8	3.90
Waterloo	15	100	26	64	81.8	......	15, 25	90	29, 30	48	70.0	......
Marble Rock	......	......	......	......	......	......	1	86	30	48	67.8	......
Iowa Falls	17	98	25	70	83.3	4,59	26	88	11, 29, 30, 31	56	79.8	......
Algona	20	93	4	65	77.2	......	15	89	30	50	66.2	......
Near Algona	20	96	27	64	78.1	......	15	86	30	47	66.5	......
Fort Dodge	20	99	28	64	80.7	5.34	15	88	20, 29, 30	54	68.4	2.83
Boonesboro'	3	101	24	56	79.0	4.60	15	92	8, 9, 31	50	67.2	3.00
Rolfe	20	99	31	64	80.2	1.26	15	92	30, 31	54	68.0	3.55
Fontanelle	20	103	24	66	84.2	6.75	17	90	29	52	69.0	3.10
Logan	19	100	25, 26	61	79.9	2.25	16	86	11, 29, 30	50	66.5	2.80
Whitesboro'	20	104	24	63	81.8	......	5	90	30	50	67.4	......
Averages	......	......	......	......	80.5	4.12	......	......	......	......	68.2	2.93
MISSOURI.												
St. Louis Univer.	18	98	25, 26	69	84.2	1.61	6	91	12, 21, 30	61	75.2	3.95
Allenton	18	109	28	64	81.6	2.30	7, 27	97	12, 21	54	72.2	5.54
Hematite	18	102	27	64	82.3	2.65	8	94	9	53	73.8	5.99
Canton	18	106	25	64	82.6	2.56	1	95	13	45	70.1	2.48
Rolla	17, 18	96	28	62	79.5	1.87	6, 7, 8	92	9	61	73.2	7.15
Jefferson City	19	101	1	73	83.0	......	6	95	10, 22, 31	60	75.0	......
Hermitage	22	108	26	68	83.8	4.09	6	100	21	54	73.2	5.54
Warrensburg	20, 22	104	26	67	84.5	1.75	6, 10	92	29	55	74.2	6.86
Harrisonville	19	105	1, 11, 25	70	82.9	1.53	11	98	29, 30, 31	54	71.7	8.95
Oregon	21	105	25	68	84.5	4.22	5	95	29	54	72.1	3.02
Averages	......	......	......	......	82.9	2.51	......	......	......	......	73.1	5.49
KANSAS.												
Atchison	20	107	24, 25	70	86.0	3.45	5	94	12, 30, 31	54	72.1	6.40
Leavenworth	21, 22	108	24	68	85.4	3.10	1	100	21, 22	48	69.3	7.15

Meteorology of 1868—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
KANSAS—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Olathe	......	......	......	......	......	......	4	97	29	54	73.1	14.40
Baxter Springs	22	106	24	70	86.3	3.40	2, 9	100	31	62	78.8	8.90
Lawrence	21	101	25	72	85.9	4.05	1, 5	93	31	57	74.2	8.32
Holton	20	111	24	69	89.1	......	5	97	30, 31	54	74.2	......
State Agr. College	20, 21	98	25	67	80.2	4.70	1	92	30	54	71.1	5.94
Council Grove	21	106	25	64	85.8	3.05	1	94	20, 22	55	75.6	15.50
Averages	......	......	......	......	85.5	3.63	......	......	......	......	73.6	9.52
NEBRASKA.												
Omaha Mission	20	105	4, 24, 31	70	83.5	2.00	......	......	......	......	......	......
Elkhorn	20	102	24	65	81.4	......	23	89	22	53	69.5	......
De Soto	20	104	24	67	82.0	3.39	5, 23	88	29, 30	53	68.8	2.45
Fontanelle	......	......	......	......	......	......	16	89	29	52	71.8	......
Bellevue	20	99	24	68	85.2	1.40	24	89	29, 30	55	70.0	1.90
Glendale	20	106	24, 25	66	83.7	3.00	1, 5	90	29	50	69.6	6.30
Nebraska City	20	99	25	68	83.2	2.82	2, 23, 24	84	31	55	73.0	5.40
Averages	......	......	......	......	83.2	2.52	......	......	......	......	70.5	4.01
UTAH.												
G't Salt Lake City	......	......	......	......	......	......	3	91	31	50	73.3	3.69
Wanship	24	95	9	60	73.8	......	3	95	30	56	72.2	......
Averages	......	......	......	......	73.8	......	......	......	......	......	72.8	3.69
CALIFORNIA.												
San Francisco	2	70	11	52	57.1	0.00	19	71	29, 30	51	57.1	0.00
Monterey	7, 29	70	1, 2, 10, 25	53	60.7	0.06	15	83	27	47	55.0	0.00
Murphy's	24	104	2, 3	52	76.0	0.00	1, 6, 19, 20, 21	100	26	52	78.0	0.00
Averages	......	......	......	......	64.6	0.02	......	......	......	......	63.4	0.00
WASHINGTON.												
Port Townsend	5	84	9	53	64.1	0.00	17, 18	85	19, 20	50	63.7	......

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
MAINE.												
Steuben	6	70	17	36	53.9	7.50	8	62	24, 31	18	41.2	3.24
West Waterville	1	80	18	32	56.7	4.73	8	72	24	21	42.7	0.70
Gardiner	1	74	18	39	56.3	8.24	8	67	31	22	43.5	0.98
Standish	1	81	30	36	56.9	8.82	8	74	30	24	44.2	1.20
Norway	1	80	17	34	55.3	......	8	74	31	16	41.6	......
Cornish	1	78	17, 18	36	55.5	8.79	8	74	24	18	42.3	1.13
Cornishville	1	79	17	34	58.2	7.13	8	72	30	24	42.9	0.65
Averages	......	......	......	......	56.1	7.54	......	......	......	......	42.6	1.32
NEW HAMPSHIRE.												
Stratford	12	84	18	30	53.9	6.17	5	64	24	10	39.6	1.29
Shelburne	1	87	18	24	56.2	......	8	72	24	14	43.0	1.70
North Barnstead	......	......	......	......	......	......	8	71	24, 30	25	45.4	1.51
Goffstown Center	1	85	18	32	57.5	16.40	8	72	18, 24	25	48.2	1.60
Claremont	11	77	18, 22	34	57.6	6.00	......	......	......	......	......	......
Averages	......	......	......	......	56.3	9.52	......	......	......	......	44.1	1.53

Meteorology of 1868—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
VERMONT.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Lunenburg.......	12	80	18	25	55.0	6.08	7	65	30	15	41.6	1.30
North Craftsbury	12	80	22	29	52.2	5.65	5, 11	60	30	11	37.4	1.20
Randolph	13	86	17, 18	30	57.0	......	8	63	30	15	41.6	0.45
Woodstock	11	76	22	30	53.8	......	11	62	24	11	39.5	......
Near St. Albans..	11	78	22	32	56.3	......	11	69	30	16	41.8	......
West Charlotte ..	13	88	17, 22	36	61.2	11.00	11	68	24	22	46.0	2.19
Middlebury	13	79	17, 22	38	56.6	4.99	11	63	24	23	43.6	1.10
Averages......	....	......	....	......	56.0	6.93	....	......	....	......	41.6	1.25
MASSACHUSETTS.												
Kingston	1	90	18, 22	43	63.3	4.71	8	75	24, 30	28	50.1	2.25
Topsfield	1	84	17, 18	34	58.5	9.01	8	73	31	18	44.7	0.95
Lawrence	11	76	18	38	56.6	13.42	8	73	24, 31	24	44.7	1.66
Georgetown......	1	87	18	38	59.0	9.25	11	73	23, 24, 31	23	45.3	1.52
Newbury	....	......	....	......	......	......	8	74	24	22	45.3	......
Milton	1	87	18	37	57.8	7.54	8	72	24	22	47.0	1.66
Cambridge	13, 18	86	18	39	62.1	......	11	78	24	22	48.2	......
North Billerica ..	1	82	18, 22	34	59.7	......	8	76	24	16	45.1	......
West Newton	....	......	....	......	......	......	8	80	24	20	48.2	......
New Bedford	1	83	17	44	62.5	5.71	8	70	30	27	49.1	1.61
Worcester........	1	80	18	40	59.8	8.60	8	73	24	26	46.2	1.14
Mendon.........	1	80	18	36	59.1	7.30	8	70	24	22	45.0	1.40
Lunenburg	....	......	....	......	......	......	8	75	24	21	45.5	1.28
Amherst	1	80	18	36	59.5	10.63	11	68	24	19	45.3	1.37
Williams College	11	77	18, 22	36	58.4	6.50	11	69	24	18	47.5	0.94
Hinsdale	11, 12, 13	75	17	38	56.5	10.30	5	66	30	16	40.0	......
Averages......	......	......	....	......	59.4	8.45	....	......	....	......	46.1	1.4
RHODE ISLAND.												
Newport	12	82	18, 30	48	63.7	4.20	7	72	24	24	48.4	2.07
CONNECTICUT.												
Pomfret..........	1	79	17	40	58.5	8.67	8	70	24	21	44.6	0.70
Columbia	1	84	18	37	63.4	......	8	76	24	22	48.7	......
Middletown	13	84	18	40	61.6	10.49	8	75	24	25	47.3	0.89
Colebrook	13	82	18	34	59.0	......	5	69	30	20	43.7	......
Waterbury	13	82	30	34	59.6	12.28	8, 11	67	24	21	45.7	0.74
Brookfield........	....	......	....	......	......	......	11	70	24	22	48.5	1.20
Averages......	....	......	....	......	60.4	10.48	....	......	....	......	46.4	0.88
NEW YORK.												
Moriches	1	94	18	44	68.3	8.03	5	78	24, 30	31	54.1	1.00
South Hartford ..	....	......	....	......	......	......	11	65	30	21	46.2	2.81
Troy	13	81	22	40	60.9	8.48	11	71	30	26	47.0	1.58
Garrison's.......	12	84	17, 18, 22, 30	43	62.0	10.30	11	70	24	27	47.0	1.05
Throg's Neck ...	13	88	17	46	65.6	......	11	68	24, 30	32	......	......
White Plains	12, 13	82	17	43	62.5	......	9	75	18, 24	30	50.7	......
Deaf & Dumb Inst	12, 13	85	17	48	64.4	9.60	11	67	18	30	50.0	2.01
Columbia College.	13	86	17	48	65.0	8.81	19	69	30	32	51.3	0.88
Flat Bush	13	88	17	46	65.1	5,99	11	68	24	31	50.5	2.66
Newburgh	....	......	....	......	......	......	11	71	17, 18, 23, 24, 30	34	50.9	0.72
Minaville	11, 12	78	22	38	57.6	6.26	11	67	30	20	42.9	2.16
Gouverneur	1, 2, 3	72	17	33	54.3	3.59	7	68	30	15	42.3	1.95
North Hammond..	12	90	17	40	61.1	5.69	10, 14	70	30	23	47.3	1.59
Houseville	11, 12	81	21	38	56.4	5.35	7	64	30	18	42.1	4.18
South Trenton ...	1	84	22, 29	42	59.5	7.15	6	63	29, 30	24	42.6	2.49
Cazenovia	12	82	21	37	56.9	......	5	67	29, 30	24	43.4	......
Oneida	12	79	17	42	60.0	10.70	7	68	29, 30	25	42.0	2.47

Meteorology of 1868—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
NEW YORK—Con.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Depauville........	11	82	22	34	57.3	4.45	7	70	30	23	43.2	3.60
Oswego	3, 10, 11	73	22	43	58.1	4.71	7	68	30	26	45.6	0.92
Palermo..........	10, 11	81	21	36	57.7	4.10	7	71	30	20	43.4	1.40
North Volney	12	82	21	39	58.3	......	7	72	29	24	45.2	......
Nichols	12	87	18	36	59.4	......	5	72	18, 30	23	45.7	......
Newark Valley ..	....	......	....	......	......	......	5, 7, 11	66	24, 30	22	43.4	......
Rochester	11	78	21	42	58.4	7.51	7	73	18	27	44.3	1.67
Little Genesee....	2, 12	78	19	35	59.6	2.95	7	74	18	18	45.3	2.25
Suspension Bridge	12	85	17	40	60.7	3.75	7	76	18	28	46.4	3.60
Buffalo	2	87	21	38	59.5	5.06	7	76	29	27	47.2	2.55
Averages......	....	......	....	......	60.4	6.44	....	......	....	......	46.2	2.07
NEW JERSEY.												
Paterson	11	90	18	42	63.2	7.71	11	69	24, 30	27	49.3	1.3
Newark	13	86	18	41	63.9	8.96	11	67	24	28	49.8	1.25
New Brunswick..	12, 13	87	19	43	64.5	7.99	11	69	24	29	48.8	1.34
Trenton..........	13	86	18	48	68.2	7.25	8	70	18, 30	32	53.5	3.21
Moorestown......	12	88	19	45	65.3	8.27	1	72	24	28	51.4	1.62
Elwood	11	90	18	39	62.2	......	8	78	18	24	53.9	......
Rio Grande	6, 23	93	18	42	69.3	5.13	....	......	....	......	......	......
Dover	12, 13	84	19, 30	41	63.1	10.85	5	67	18,24,30	29	49.2	1.15
Haddonfield......	12	86	18	45	67.7	10.10	11	67	24	31	51.2	1.58
Newfield	13	95	30	49	66.9	......	1	80	18, 24	27	52.2	......
Greenwich	12	86	18,19,30	47	67.2	7.79	1	70	18	32	53.4	0.72
Vineland	13	96	18	44	68.2	5.45	1, 5	78	18	25	53.5	1.08
Averages......	....	......	....	......	65.8	8.00	....	......	....	......	51.5	1.47
PENNSYLVANIA.												
Nyces............	12	80	17	30	58.0	4.90	9	79	30	18	44.6	2.05
Fallsington	12, 13	87	18	46	66.0	6.80	10	71	24	31	51.7	1.60
Philadelphia	12	87	17	49	67.9	8.61	1	70	18, 24	35	53.4	2.24
Germantown... ..	13	90	28	43	65.7	......	12	77	24	29	51.2	......
Horsham	12	85	18	44	64.1	8.40	11	70	24	29	50.5	1.67
Plymouth Meeting	12	86	18, 19	42	65.1	......	11	70	24	29	51.1	......
Dyberry..........	12	84	18, 19	30	56.6	......	5	69	18, 30	20	43.3	......
Lehigh University	12	85	18	38	61.6	......	11	67	24	25	47.2	......
White Hall..	12	84	18, 19	35	63.6	......	11	65	24	24	48.1	......
Factoryville......	12	85	18	32	58.7	4.50	11	68	18	20	44.8	1.02
Reading..........	12	84	18	40	63.9	......	1, 6, 11	69	18, 24	31	51.6	......
Parkersburg	11, 12	89	18	44	66.5	9.40	13	69	24	27	52.4	1.56
West Chester	11,12,13	82	18	48	62.3	8.24	1	68	18, 24	33	52.0	1.16
Silver Spring	11, 12	90	18	40	64.1	......	1, 11	72	24	25	50.7	......
Mount Joy	12	91	19, 30	43	64.7	......	11	72	18	28	50.9	......
Harrisburg	12	85	18, 19	47	65.1	5.58	7, 11	68	24	30	51.0	0.60
Fountain Dale....	11, 12	82	19	43	62.8	6.86	1, 11	70	18	30	49.5	1.60
Tioga	12	90	17, 19	38	62.5	7.90	1	68	18	12	41.6	2.15
Lewisburg	12	84	30	38	60.7	5.71	11	68	18	24	46.8	0.83
Ickesburg........	12	84	18	35	61.9	4.86	11	74	30	23	48.5	0.88
Grampian Hills ..	2	81	18	30	56.6	6.36	13	68	18	17	43.5	2.96
Johnstown	2	76	18	33	57.3	10.92	1	67	30	29	46.8	1.97
Franklin	12	81	18	35	59.2	4.88	7	73	18	22	46.4	2.68
Connnellsville....	2, 13	80	18	35	61.4	......	7	78	18	20	49.5	......
New Castle	11	82	18	32	61.8	......	2, 7	70	18	22	50.2	......
Beaver	12	79	18	43	60.8	2.00	7	74	18	26	50.3	0.50
Canonsburg	12	84	18	37	61.4	7.96	7	77	18, 24	25	50.0	1.52
Averages......	....	......	....	....	62.2	6.70	....	......	....	......	48.8	1.59
MARYLAND.												
Woodlawn	13	90	18	44	66.0	8.13	11	74	18	30	52.2	2.10
Annapolis........	10, 11	86	30	49	69.7	6.34	1	71	18	31	56.1	1.57
St. Inigoes	12	90	17	52	70.3	6.15	7	74	23	36	54.5	0.68
Emmittsburg.....	12	86	17	42	64.1	......	11	78	18	22	49.9	......

Meteorology of 1868—Continued.

Stations in States and Territories.	September. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	October. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
MARYLAND—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Mt. St. Mary's Col.	12	83	17, 18	44	62. 2	7. 78	11	69	24	29	49. 9	1. 97
Averages......	....	......	....	......	66. 5	7. 10	....	......	....	......	52. 5	1. 58
VIRGINIA.												
Surry Ct. House..	1, 13	93	17, 30	50	74. 1	......	7	83	23	33	59. 5	......
Johnsontown	1, 11	89	17	52	71. 7	......	1, 8	76	18	36	57. 7	......
Comorn	....	......	....	......	......	......	1	75	24	34	55. 7	1. 10
Staunton	12	84	18, 19	45	66. 8	0. 68	1	74	18, 23	35	53. 0	2. 88
Mt. Solon	27	86	25	32	50. 6	4. 50	1	78	18,23,29	32	56. 5	4. 00
Lynchburg	11	84	18	47	69. 1	......	1	72	18	37	57. 2	......
Snowville	11	85	18	36	63. 8	12. 60	11	75	18	24	51. 4	17. 20
Wytheville	11	84	18	36	64. 0	4. 27	11	76	23	26	53. 3	2. 55
Averages......	....	......	....	......	67. 0	5. 51	....	......	....	......	55. 5	5. 55
WEST VIRGINIA.												
Romney...........	11	86	18	38	63. 5	......	1	78	18	26	51. 2	......
White Day	12	86	18	40	68. 5	......	2, 7	84	18	26	55. 3	......
Weston	12	85	18, 19	40	63. 8	......	....	......	....	......	......	......
Averages......	....	......	....	......	65. 3	......	....	......	....	......	53. 3	......
NORTH CAROLINA.												
Kenansville	13	96	30	46	75. 2	1. 41	14	82	23	38	62. 2	11. 22
Goldsboro'	2	96	30	51	75. 2	0. 92	7, 8	82	23, 24	38	61. 2	5. 00
Raleigh	10, 12	95	30	49	73. 8	2. 66	1, 14	85	25	35	60. 5	3. 75
Oxford	2, 13	88	30	44	71. 4	2. 95	2	78	18, 24	30	56. 5	1. 80
Albemarle........	1	90	18	42	71. 0	7. 29	8, 12	83	24	28	57. 2	5. 54
Statesville........	1	85	30	41	56. 9	3. 69	1, 2, 11, 13, 28	70	24	29	54. 7	5. 25
Asheville	8, 9, 12	83	30	42	66. 7	......	11, 12	75	23, 24	31	55. 6	......
Averages......	....	......	....	......	70. 0	3. 15	....	......	....	......	58. 3	5. 43
SOUTH CAROLINA.												
Aiken............	1, 13, 23, 24	87	18	50	73. 1	4. 04	8	79	23, 24	42	......	3. 57
Gowdeysville.....	12	89	18, 30	50	72. 8	......	8	82	23, 25	37	62. 0	......
Averages......	....	......	....	......	73. 0	4. 04	....	......	....	......	62. 0	3. 57
GEORGIA.												
Atlanta	1	87	18, 19	48	70. 1	3. 84	12	76	24, 25	35	55. 7	8. 87
Penfield..........	14	90	18	48	74. 0	3. 18	12	79	24	37	61. 4	3. 20
Averages......	....	......	....	......	72. 1	3. 51	....	......	....	......	58. 6	6. 04
ALABAMA.												
Opelika	13	91	18	54	74. 9	4. 59	11	87	20	43	62. 7	9. 75
Carlowville	16	91	26	56	76. 3	6. 21	7	82	24	46	65. 4	17. 06
Moulton..........	11	86	26	47	69. 0	5. 27	1	76	23	34	58. 5	1. 58
Greene Springs...	1	89	26	51	73. 7	3. 67	7	78	23, 25	39	61. 9	7. 17
Havana	1, 11	87	26, 27	52	72. 6	4. 98	1	80	25	40	62. 6	10. 00
Fish River	13, 15	89	25	63	79. 4	6. 29	5	83	....	......	......	......
Averages......	....	......	....	......	74. 3	5. 15	....	......	....	......	62. 2	9. 11
FLORIDA.												
Jacksonville	24, 25	94	18	62	81. 2	6. 15	8	88	24, 26	55	72. 9	3. 20

Meteorology of 1868—Continued.

Stations in States and Territories.	SEPTEMBER.						OCTOBER.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
TEXAS.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Gilmer	8	98	26	48	74.6	5.51	3	88	22	38	66.9	2.14
Houston	9, 10, 11, 12	82	24	65	73.6	......	7, 14	79	9, 26, 29	60	70.2	......
Columbia	12	97	26	59	78.5	2.50	14, 15	93	9	47	71.2	3.63
Waco	20	96	23	53	77.0	2.80	6	88	23, 25	47	67.3	4.80
Austin	12, 22, 24	94	23	53	77.4	1.72	5	93	24	45	69.0	4.65
Averages	....	......	....	......	76.2	3.13	....	......	....	......	68.9	3.81
LOUISIANA.												
New Orleans	22, 24	89	18	72	......	......	12	86	24	60	......	......
Benton	8	89	26	50	75.0	......	14, 16	82	9	42	65.9	......
MISSISSIPPI.												
Grenada	7, 8	88	26	44	72.9	......	1, 6, 7	80	23	37	62.6	......
Brookhaven	10	92	26	53	77.0	......	13	82	23	44	63.0	......
Natchez	11, 12	88	25, 27	55	73.8	3.50	1	80	23	40	66.7	2.85
Averages	....	......	....	......	74.6	3.50	....	......	....	......	64.1	2.85
TENNESSEE.												
Elizabethton	11	89	30	42	67.2	......	13	80	22, 23	28	56.9	......
Tusculum College	11	91	18, 19, 30	46	68.8	5.15	....	......	....	......	......	......
Lookout Mountain	8	85	25, 26	49	70.0	......	6, 7, 12	74	9	42	60.1	......
Austin	2, 8, 9	86	26	44	68.7	10.20	7	82	23	32	57.8	0.75
Clarksville	8	87	25	45	65.8	3.80	7	77	23	33	56.0	1.56
Memphis	7	95	24	51	71.7	9.31	1	85	23	36	59.1	0.06
Averages	....	......	....	......	68.7	7.12	....	......	....	......	58.0	0.79
KENTUCKY.												
Pine Grove	9	86	26	36	63.3	8.63	2	78	18, 23	28	54.0	2.02
Lexington	8	84	17, 18, 26	42	63.6	7.81	2	76	18	29	54.2	1.95
Danville	15	90	17	48	68.8	9.75	2	88	18, 23	35	60.4	1.53
Louisville	8	87	26	38	65.4	5.57	2	81	23	30	55.5	1.95
Clinton	8	88	26	43	66.2	5.89	7	78	9	31	55.5	2.25
Averages	....	......	....	......	65.5	7.53	....	......	....	......	55.9	1.94
OHIO.												
New Lisbon	11	85	18	34	63.0	2.38	2	76	18	20	51.5	1.19
Steubenville	2, 12	78	18	43	64.1	......	7	74	18	27	52.0	......
Painesville	12	78	17, 21	44	59.3	7.75	7	70	9, 17, 18, 24	32	47.0	2.06
Milnersville	1	85	18	36	59.3	5.33	7	75	23	26	48.7	......
Cleveland	12, 15	79	17, 18	43	59.7	4.72	7	75	18	29	48.3	1.09
Smithville	14	86	17	38	62.4	......	5, 7	74	18	26	50.3	......
Wooster	1	87	18	38	63.7	3.58	5, 7	78	18	27	51.5	0.52
Gallipolis	....	......	....	......	......	......	2	80	18, 23	28	53.3	1.15
Kelley's Island	10, 12	83	25	47	63.9	3.29	7	73	23	32	50.8	0.78
Sandusky	10	78	17	40	57.6	3.20	7	73	23	25	49.0	1.12
Norwalk	3	78	17, 26	42	59.6	2.17	7, 30	72	18, 23	26	48.8	0.31
North Fairfield	3, 10, 11, 12, 15	78	26	42	60.6	2.71	5	72	23	26	50.2	0.77
Westerville	3	80	26	42	......	5.72	5	73	23	21	49.3	0.95
Marion	3, 8	78	17	36	59.0	3.57	7	73	23	21	47.2	0.97
Hillsboro'	8	78	17	40	60.2	8.89	2	72	23	27	50.8	1.24
Toledo	11, 12	82	17	36	59.9	2.50	7	74	23	19	47.9	1.63
Bowling Green	5, 8, 11, 12	82	17	38	62.1	6.30	7	80	23	20	49.9	1.82
Kenton	1	80	18	46	63.9	8.19	7, 13	67	17, 23	36	50.7	2.13
Urbana University	8	81	26	37	60.5	3.81	7	75	23	22	49.9	1.17
Bethel	8	85	26	38	61.6	6.75	1	78	23	26	50.5	1.13

Meteorology of 1868—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
OHIO—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Jacksonburg	8	81	17	41	62. 5	6. 69	2	76	23	28	52. 7	1. 69
Cincinnati (H)	8	82	17	43	62. 3	7. 19	2	75	23	30	52. 5	1. 22
Do. (P)	4, 8, 15	84	26	44	67. 7	8. 21	5	86	23	34	57. 4	1. 10
College Hill	8	88	17	40	63. 1	5. 88	2	75	18, 23	30	57. 7	1. 19
Averages	......	......	......	......	61. 6	5. 18	......	......	......	......	50. 7	1. 20
MICHIGAN.												
Monroe City	11	72	21, 23	36	53. 2	3. 55	27	68	22	29	40. 8	1. 07
State Agr. College	10	83	17, 21	32	58. 8	2. 95	5	69	23	12	45. 2	1. 11
Litchfield	12	81	21, 25	36	57. 6	4. 19	30	68	17	22	44. 6	1. 60
Cold Water	11	80	21	33	57. 2	4. 25	5, 30	68	23	20	41. 7	1. 31
Grand Rapids	12	85	21	34	57. 8	......	30	70	17	24	44. 9	......
Northport	10	74	20	32	55. 2	......	5	60	22	23	43. 1	3. 00
Muskegon	......	......	......	......	......	......	30	70	23	24	45. 3	2. 20
Holland	10, 11	81	21	34	57. 4	5. 66	10	66	22	25	45. 3	1. 06
Otsego	10	84	21	32	57. 1	......	10	70	22	24	45. 1	......
Copper Falls	7	64	24	27	46. 3	2. 29	4	62	28	20	36. 7	2. 87
Ontonagon	8	66	20, 21, 23, 24	36	53. 9	......	4	64	17	28	43. 3	......
Averages	......	......	......	......	55. 5	3. 82	......	......	......	......	43. 5	1. 78
INDIANA.												
Aurora	8	90	26	39	64. 1	6. 08	1	80	23	26	52. 5	1. 05
Vevay	8	86	17, 26	44	65. 8	6. 72	2, 7	80	18	30	54. 9	1. 30
Muncie	8	83	26	34	61. 6	6. 30	6	75	17, 23	27	50. 4	1. 75
Spiceland	8, 15	81	17, 26	39	60. 6	4. 27	2, 5, 7	73	23	26	50. 2	1. 20
Columbia City	11	86	17, 19, 28	34	56. 3	6. 63	......	......	......	......	......	......
Jalapa	11	81	25	41	60. 4	6. 50	30	74	22	29	50. 0	0. 75
Indianapolis	8	81	26	36	59. 7	5. 31	7, 30	71	23	26	50. 5	1. 16
State University	8	82	17, 25	40	62. 6	......	2, 7	72	18	32	51. 6	......
Rensselaer	12	82	17	38	62. 9	11. 37	26, 30	71	17	30	51. 9	2. 50
Merom	8, 12	84	17	41	64. 4	6. 12	2, 5	76	17, 23	32	54. 3	1. 35
New Harmony	8	85	25	46	67. 5	8. 49	2, 7	76	23	33	55. 4	1. 31
Averages	......	......	......	......	62. 4	6. 78	......	......	......	......	52. 2	1. 37
ILLINOIS.												
Chicago	12	84	23	43	63. 2	7. 08	26	74	8	37	52. 9	1. 69
Near Chicago	2	90	16, 17	38	61. 3	......	10, 26, 30	74	17	30	50. 2	......
Ridge Farm	10, 11	84	17, 23	40	61. 3	5. 90	30	75	23	30	51. 5	1. 40
Marengo	12	83	17	30	55. 5	6. 67	30	69	17	17	45. 2	1. 30
Golconda	10	97	17	40	72. 6	4. 70	6	89	23	29	66. 8	1. 10
Aurora	12	80	23	32	56. 7	5. 47	26	72	17	25	46. 2	2. 07
Sandwich	10	84	23	33	57. 9	2. 10	30	72	17	21	46. 1	0. 95
Belvidere	2, 12	78	21	38	55. 8	7. 16	26	76	17	24	45. 8	0. 65
Ottawa	2	83	23	36	58. 3	3. 48	......	......	......	......	......	......
Winnebago	10	81	23	31	58. 9	5. 23	26	75	17	19	45. 6	0. 80
Rochelle	10, 12	82	23	31	56. 5	......	26	75	17	18	46. 2	......
Wyanet	10	86	23	39	59. 5	4. 61	1	79	17	22	49. 0	1. 24
Tiskilwa	10	87	23	33	58. 5	......	26	72	17	22	48. 9	......
Hennepin	10	86	23	34	59. 0	......	26	78	17	24	51. 0	......
Elmira	10	82	23	32	58. 2	2. 61	26	74	17	24	49. 6	0. 20
Peoria	12	83	17	38	61. 3	4. 46	26	77	17	29	51. 9	1. 41
Springfield	14	89	16, 17, 18, 24	40	59. 4	......	6	80	8, 9, 17	30	51. 6	......
Dubois	12	84	26	30	56. 8	13. 60	5	78	10	24	47. 8	1. 30
Waterloo	2, 11, 12	82	23	43	65. 6	......	26	77	8	32	57. 1	......
South Pass	8	93	23, 26	43	67. 0	......	......	......	......	......	......	......
Galesburg	10	81	23	33	59. 0	5. 28	26	75	8, 17	27	48. 6	1. 14
Manchester	11	85	16	41	63. 3	3. 89	26	81	17	29	53. 3	1. 44
Mt. Sterling	10	90	23	38	64. 3	......	6, 25	73	17	28	53. 5	......

Meteorology of 1868—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
ILLINOIS—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Andalusia	10	81	23	33	59.8	......	5	70	17	26	50.2	......
Augusta	11	83	16, 17, 23	42	62.8	4.29	5	70	17	26	52.2	1.76
Averages	....	....	....	....	60.5	5.41	....	....	....	....	50.5	1.23
WISCONSIN.												
Manitowoc	10, 12	77	21	34	55.3	3.72	5	64	17	25	43.3	2.31
Plymouth	10	78	21	27	53.1	3.60	4	66	17	20	42.0	2.80
Hingham	....	....	....	....	......	......	5, 27	65	17	20	44.8	......
Milwaukee	8, 12	79	21	33	56.4	0.90	4	67	22	21	45.6	1.18
Appleton	12	72	23	36	......	......	5	61	17, 22	25	43.1	......
Geneva	10	81	21, 23	32	56.9	4.21	26	72	17	21	45.9	1.35
Waupacca	1	75	23	35	54.3	......	4	72	17	22	44.1	......
Embarrass	1	74	20	31	52.0	5.06	5	64	17	20	42.1	2.51
Rocky Run	1	78	23	32	55.0	1.88	4	71	17	17	45.2	1.53
Edgerton	9, 11, 12, 13	80	23	30	57.2	2.13	26	72	17	18	46.5	3.00
Bayfield	5	74	25	28	49.2	......	....	....	....	....	......	......
Averages	....	....	....	....	54.4	3.07	....	....	....	....	44.3	2.10
MINNESOTA.												
Beaver Bay	5, 8	71	23	30	48.7	4.67	4	70	16	20	40.5	2.03
St. Paul	9, 11	72	25	23	51.5	2.88	4	77	17	16	43.6	4.56
Minneapolis	4	72	25	25	50.5	2.78	4	78	17	19	42.7	4.92
Sibley	11	79	25	18	46.6	2.96	26	70	17	14	43.1	2.25
New Ulm	11	80	25	34	56.9	3.89	4	79	22	23	47.0	2.66
Sauk Center	7	73	23, 25	22	48.9	3.44	4	76	17	14	41.1	1.49
Averages	....	....	....	....	50.5	3.44	....	....	....	....	43.0	2.99
IOWA.												
Clinton	9, 10	86	17	38	61.2	5.20	26	80	17	32	52.2	1.20
Davenport	10	89	23	35	57.9	5.85	26	72	17	24	47.8	2.64
Dubuque	8	78	25	38	57.1	5.06	26	74	17	27	47.1	1.31
Monticello	2, 8, 10, 11	78	17, 23	34	55.1	6.72	25	75	16	26	45.6	0.65
Bowen's Prairie	11	78	23	32	54.5	7.20	26	72	17	22	49.0	1.26
Fort Madison	11	87	23	29	60.1	2.05	30	72	17	25	51.0	1.83
Guttenberg	1, 11	81	23	26	53.1	......	26	78	17	16	43.1	......
Mt. Vernon	8	82	23	30	56.6	......	26	71	17	19	46.1	......
Iowa City	1, 10	81	17, 23	32	58.8	5.17	1, 26	73	17	25	49.8	0.33
Independence	11	85	23	32	55.3	6.00	26	77	17	16	......	1.70
N'r Independence	1	83	22, 23	29	54.8	8.60	26	76	17	22	46.4	0.06
Waterloo	11	81	22	32	54.8	......	26	78	17	14	46.0	......
Marble Rock	11	76	24	33	54.7	......	4, 24	70	17	24	47.2	......
Iowa Falls	11	78	17, 23	32	57.3	......	26, 30	72	17	22	49.7	2.26
Algona	11	77	25	30	52.2	......	4	80	8	22	45.2	......
Near Algona	11	79	22	31	52.0	......	4	81	17	19	45.0	......
Fort Dodge	11	82	23, 24, 25	34	53.8	1.85	26	73	17	19	46.6	1.20
Boonesboro'	11	82	17, 23	33	56.6	3.55	25, 26	74	17	20	48.1	0.24
Rolfe	11	82	23, 24	33	53.5	4.89	4	84	22	25	46.7	1.25
Fontenelle	11	86	22, 23	35	57.2	5.63	26	77	17	19	49.0	1.13
Logan	11	83	23	31	54.9	4.20	4, 6	76	17	22	49.4	......
Woodbine	11	86	23	28	54.8	......	6, 26	74	8	18	46.4	......
Averages	....	....	....	....	55.8	5.14	....	....	....	....	47.5	1.22
MISSOURI.												
St. Louis Univ'ty	11	83	23	44	64.7	5.43	5	75	17	33	55.7	1.97
Allenton	2	85	17	35	62.5	7.19	26	83	8	31	54.4	1.90
Hematite	12	87	17	35	64.4	7.05	25	84	9	28	57.3	1.80
Canton	11	87	23	29	62.3	4.64	10	73	8	27	51.8	2.37
Rolla	8	83	17	42	64.1	4.85	5	78	9	32	55.4	1.34

Meteorology of 1868—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
MISSOURI—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Jefferson City	......	......	......	......	......	......	25	80	8	30	54.0	......
Hermitage	5	92	17	37	65.6	6.12	6	88	8	30	56.7	1.47
Warrensburg	11	90	23	35	65.1	2.24	6	83	8	28	58.2	2.05
Harrisonville	11	86	23	40	61.9	6.63	6	86	8	28	53.8	2.53
Oregon	11	93	23	35	61.1	2.87	25	83	8, 22	29	55.1	1.68
Averages	......	......	......	......	63.5	5.22	......	......	......	......	55.2	1.90
KANSAS.												
Atchison	5	91	23	30	61.8	7.30	6	84	8, 22	28	54.5	8.80
Leavenworth	5, 11	90	23	26	60.6	2.72	6	84	8, 22	24	52.3	1.71
Olatha	11	90	23	33	61.3	0.50	6	81	8	26	......	2.50
Baxter Springs	11	95	17, 23, 24	46	69.8	13.65	5	86	8	34	60.8	2.15
Lawrence	5	93	23	29	62.4	4.29	6	81	22	27	53.1	1.58
Holton	11	93	17	32	62.1	......	6	83	22	25	52.4	......
State Agr. Coll.	10	87	23	34	60.7	5.72	6	79	8	32	53.1	2.51
Council Grove	5, 11	88	23	33	65.6	10.25	6	84	22	31	57.7	3.05
Averages	......	......	......	......	63.0	6.35	......	......	......	......	54.8	3.19
NEBRASKA.												
Dakota	......	......	......	......	......	......	2	90	17	22	48.7	......
Omaha Mission	......	......	......	......	......	......	4	78	17	26	50.3	1.70
Elkhorn	11	86	22	36	56.9	......	4	82	7, 17	28	50.6	......
De Soto	11	86	22	33	54.5	3.27	4	81	17	25	49.3	0.82
Fontenelle	11	90	23	30	57.7	......	4	88	17	25	52.2	1.60
Bellevue	11	85	23	36	59.1	2.20	25	82	8, 17	33	52.5	1.30
Glendale	11	86	22	30	57.3	2.35	4	85	7, 21	25	49.7	1.90
Nebraska City	11	84	23	41	63.6	......	4, 6	80	17	33	53.5	6.47
Averages	......	......	......	......	58.2	2.61	......	......	......	......	50.9	2.30
UTAH.												
Wanship	......	......	......	......	......	......	3	75	8	21	54.7	......
CALIFORNIA.												
San Francisco	4	70	12, 13	50	56.7	0.00	......	......	......	......	......	......
Monterey	9	81	21, 22	46	45.0	0.00	10	90	30	41	57.1	0.55
Murphy's	1	98	19	36	65.8	0.00	8, 9, 10	84	16, 19, 28, 30, 31	32	56.3	0.12
Averages	......	......	......	......	55.8	0.00	......	......	......	......	56.7	0.34

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
MAINE.												
Steuben	1	53	17	11	31.8	5.69	8	38	27	— 8	22.0	2.10
West Waterville	1	57	17, 28	16	32.4	7.90	8	39	31	— 7	19.5	1.60
Gardiner	1	56	17	17	33.7	6.76	8	39	27	—10	20.9	2.04
Standish	1	56	17	18	34.4	6.91	21	38	25, 27	— 2	21.3	2.06
Norway	1	54	17	10	31.0	......	8	36	27	—18	16.6	2.06
Cornish	1	52	28	13	31.2	5.65	21, 22	34	27	— 8	18.5	2.96
Cornishville	1	54	28	16	32.0	6.64	21	36	27	— 1	19.5	2.65
Averages	......	......	......	......	32.4	6.59	......	......	......	......	19.8	2.21
NEW HAMPSHIRE.												
Concord	1	55	17	19	35.0	......	......	......	......	......	......	......

Meteorology of 1868—Continued.

Stations in States and Territories.	November. Date.	November. Maximum temperature.	November. Date.	November. Minimum temperature.	November. Mean temperature.	November. Rain and melted snow.	December. Date.	December. Maximum temperature.	December. Date.	December. Minimum temperature.	December. Mean temperature.	December. Rain and melted snow.
NEW HAMPSHIRE—Continued.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Stratford	1	50	17	5	27.6	6.88	21	33	27	—20	13.9	2.45
Shelburne	1	57	18	20	32.6	......	8	36	27	—26	16.2	2.19
North Barnstead	4	48	17	24	34.8	2.87	10	54	25	0	22.8	1.69
Goffstown Center	1	56	17	23	36.8	5.60	21	39	25	0	24.0	1.48
Claremont	1	52	17	20	33.2	5.90	......	......	......	......	......	......
Averages	......	......	......	......	33.3	5.31	......	......	......	......	19.2	1.95
VERMONT.												
Lunenburg	1	54	17, 30	14	29.6	7.15	21	32	27	—30	13.8	2.45
North Craftsbury	1	48	17	10	27.4	5.84	21	35	19, 27	—10	14.5	2.51
Randolph	1	53	24	14	31.6	7.03	17, 21, 22	33	27	—24	16.6	2.82
Woodstock	1	53	4, 23	14	29.9	......	21	34	27	—25	14.5	2.50
Near St. Albans	1	46	16	16	30.2	......	21	35	19	—19	15.3	......
West Charlotte	1	51	17	21	34.5	8.88	21	39	24, 25, 26	0	21.9	1.23
Middlebury	1	51	30	18	32.5	6.38	21	36	27	—13	18.8	1.09
Averages	......	......	......	......	30.8	7.06	......	......	......	......	16.5	2.10
MASSACHUSETTS.												
Kingston	1	65	17	27	42.2	3.62	21	52	25, 27	10	31.0	3.10
Topsfield	1	60	17, 28	20	34.6	4.88	7	43	25, 27	2	23.1	1.21
Lawrence	1	55	17	23	36.8	6.69	21	42	25	3	25.0	0.63
Georgetown	14	65	13	17	36.3	5.60	22, 29	42	25	0	23.5	3.15
Newbury	1	59	13, 16, 17	22	36.1	......	21	44	25	2	24.9	......
Milton	1	57	17	20	36.6	4.49	21	48	27	4	37.2	1.55
Cambridge	4	60	17	22	37.8	......	21	42	27	3	26.0	......
North Billerica	1	58	16, 17	19	35.5	......	28	48	26	1	25.4	......
West Newton	1	64	13, 28	22	37.4	......	21	45	27	2	26.3	0.88
New Bedford	1, 5, 9	57	16, 28	26	40.5	2.85	21	48	25	6	28.5	2.23
Worcester	2	58	16, 28	25	37.6	4.24	21	44	25, 27	3	23.9	1.85
Mendon	1	57	16, 17	22	36.2	3.25	21	44	27	1	22.5	......
Lunenburg	1	55	16	20	35.2	4.90	21	40	25	— 1	22.6	1.53
Amherst	1	58	20	24	36.5	4.80	21	40	27	— 5	22.8	1.47
Richmond	9	53	7	20	35.7	6.40	......	......	......	......	......	......
Williams College	9	61	30	22	36.0	4.42	21	38	25	0	21.8	2.49
Hinsdale	9	57	16	19	33.9	4.35	21	36	19	— 2	19.5	1.89
Averages	......	......	......	......	36.8	4.65	......	......	......	......	24.6	1.83
RHODE ISLAND.												
Newport	9	56	17	24	39.4	4.32	21	46	25	5	26.4	2.54
CONNECTICUT.												
Pomfret	9	62	16, 17	24	36.6	4.42	21	40	24, 25	4	23.0	1.10
Columbia	9	64	17, 27	28	39.6	......	21	40	24, 27	4	25.7	......
Middletown	9	67	17, 28	24	38.5	3.85	21	41	25	3	23.5	2.38
Colebrook	9	65	28	21	35.1	......	21	35	11, 24	— 1	19.5	......
Waterbury	9	66	28	22	38.5	4.94	21	44	25	2	25.1	3.31
Brookfield	9	70	28	22	38.9	3.50	21	48	25	— 2	25.7	3.50
Averages	......	......	......	......	37.9	4.18	......	......	......	......	23.8	2.57
NEW YORK.												
Moriches	9	66	28	24	45.1	5.54	21	54	25	8	32.3	3.92
South Hartford	9	59	17, 30	22	36.5	8.30	21	38	27	—13	21.9	3.15
Troy	9	58	30	26	38.3	4.94	21	42	27	0	24.4	1.64
Garrison's	9	70	28	26	39.2	6.42	17	44	24	7	25.2	2.02
Throg's Neck	9	67	23, 28	30	42.0	......	21	48	25	8	28.4	......
White Plains	9, 10	70	24	27	42.9	......	2, 8	50	24	9	28.5	......
Deaf & Dumb Inst.	9	66	13, 23	30	42.1	5.13	21	43	25	10	28.1	4.27
Columbia College	9	65	23	30	42.4	3.46	21	41	25	10	28.0	2.02

Meteorology of 1868—Continued.

Stations in States and Territories.	NOVEMBER.						DECEMBER.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
NEW YORK—Con.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Flat Bush	9	67	28	29	39.8	4.03	21	46	25	11	28.8	2.42
Newburg	9	70	16	29	41.9	4.28	28	44	24	8	26.9	2.14
Minaville	1	54	30	17	32.4	5.81	21	34	17, 27	— 5	16.1	3.40
Gouverneur	13	46	23	15	32.0	5.13	20	30	27	—26	12.3	1.77
North Hammond	1	56	23	20	35.2	6.37	20, 21	42	24	— 8	20.5	1.97
Houseville	4	49	30	14	33.4	4.95	20	37	24	— 8	18.2	3.97
South Trenton	27	44	3	22	32.6	4.74	18	38	26	—20	20.3	3.90
Cazenovia	10	59	30	15	35.5	......	20, 29	37	19	— 7	22.2	5.57
Oneida	4	53	30	19	36.0	10.64	20	40	24	6	23.6	4.00
Depauville	4, 14	50	23	18	34.1	[illegible]	20	40	22	— 4	20.7	[illegible]
Oswego	13	49	30	22	37.4	6.44	21	40	19	0	24.0	5.12
Palermo	4	51	30	15	34.4	6.63	21	39	19	— 6	20.0	6.80
North Volney	4	54	30	18	35.8	......	20	40	19	— 3	22.6	......
Nichols	9	66	30	24	38.3	......	29	43	12	— 1	25.3	......
Newark Valley	9, 10	60	30	20	35.7	......	20	40	11	— 8	22.0	3.10
Rochester	4	52	30	24	37.5	4.42	20	41	24	7	25.8	3.28
Little Genesee	10	64	30	22	36.8	2.25	20	43	11	—14	22.1	2.45
Suspension Bridge	4	58	30	25	38.2	4.95	20	49	24	6	25.1	2.60
Buffalo	4	57	30	22	38.2	4.92	20	40	24	7	25.4	2.25
Averages	......	......	......	......	37.5	5.50	......	......	......	......	24.0	3.22
NEW JERSEY.												
Paterson	9	70	23, 28	27	41.2	5.05	21	42	25	5	26.7	4.52
Newark	9	68	13, 23	29	42.3	4.38	21	43	25	8	28.1	3.85
New Brunswick	9	66	28	26	41.7	4.89	17	42	25	9	27.3	3.32
Trenton	10	70	28	28	45.7	5.00	21	47	25	11	31.2	5.13
Moorestown	10	75	28	25	43.0	4.91	20	45	24	11	29.2	2.98
Ellwood	10	73	28	23	43.6	......	......	......	......	......	......	......
Newton	......	......	......	......	......	......	17	46	11, 24	6	23.9	2.45
Dover	9	71	13	20	41.6	4.82	17, 21, 28	42	11	6	28.0	4.87
New Germantown	9	70	13	23	39.8	6.70	17, 21, 28	40	11, 25	8	28.0	1.80
Haddonfield	9	66	28	30	43.3	5.60	20	45	24	15	30.2	3.52
Newfield	10	75	28	21	42.6	......	7	50	25	10	29.7	......
Greenwich	10	73	13, 28	30	44.8	6.39	7	50	13	15	32.1	2.92
Vineland	10	77	28	26	43.7	7.24	21	50	24, 25	10	29.9	4.40
Averages	......	......	......	......	42.8	5.50	......	......	......	......	28.7	3.61
PENNSYLVANIA.												
Nyces	9	66	28	16	31.5	5.10	28	43	11	— 8	21.5	1.65
Fallsington	10	72	13	29	43.3	4.70	28	43	24, 25	13	29.7	[illegible]
Philadelphia	10	72	23	35	45.9	4.53	21	45	24	18	32.6	4.27
Germantown	10	5.7	12, 13, 22, 23, 24	29	42.2	......	7	45	25	12	28.7	......
Horsham	9	71	28	27	42.8	6.35	30	46	13, 24	11	28.3	2.10
Plymouth Meeting	10	71	13, 28	27	42.8	......	20	47	24	12	29.5	1.19
Dyberry	9	62	28	18	35.8	......	17	38	11	— 9	21.8	......
Lehigh University	9	68	28	26	40.9	......	......	......	......	......	......	......
White Hall	9	68	28	25	41.8	......	5, 21, 28	39	11	1	27.1	......
Factoryville	10	65	24	22	37.2	4.22	17	38	11	— 4	23.0	1.85
Reading	9, 10	73	28	30	44.1	......	6	44	11, 13	11	30.1	......
Parkesville	10	70	23, 28	30	42.3	4.56	20	44	13	12	29.0	2.42
West Chester	10	72	12, 13, 23, 28	33	45.1	5.47	28	48	13	13	30.5	3.14
Silver Spring	10	78	28	20	42.4	......	20	45	26	7	29.0	......
Mount Joy	8	86	13, 14	31	46.1	......	15	47	26	10	30.8	......
Harrisburg	9, 10	67	28	31	43.3	6.22	6, 18	38	26	15	28.7	2.82
Fountaindale	9, 10	72	28	28	42.5	5.12	17, 21	42	11	9	27.7	3.10
Tioga	9, 10	60	30	18	33.6	4.80	17, 20	36	20	—11	17.7	2.05
Lewisburg	18	68	14, 28	25	39.7	5.40	17	41	11	0	24.9	2.14
Ickesburg	9, 10	70	28	20	41.3	6.86	17	46	11	0	26.3	2.55
Grampian Hills	4, 9, 10	60	28	20	35.5	3.26	20	38	13	4	20.5	4.55
Johnstown	8, 9, 10	60	24	23	38.8	......	6	47	11	3	26.7	2.90
Franklin	9	62	27	24	38.2	4.45	20	50	10, 12	0	24.7	3.07

Meteorology of 1868—Continued.

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
PENNA.—Con.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Connellsville	9	68	3	24	40.1	......	20	52	12	0	25.4	......
New Castle	9, 10	64	27	24	41.2	......	20	51	11	7	27.0	......
Beaver	9	67	3	26	42.6	3.10	20	53	11	10	30.7	3.10
Canonsburg	9	69	3, 23	25	41.3	2.96	20	57	11, 12	7	28.3	1.69
Averages	......	......	......	......	40.8	4.[illegible]	......	......	......	......	27.0	2.6[illegible]
MARYLAND.												
Woodlawn	10	72	3, 13, 28	30	43.8	8.42	21	55	13	10	29.6	3.61
Annapolis	10	74	28	28	48.4	5.40	21	52	13	12	35.9	3.08
St. Inigoes	9	74	23	32	49.2	3.95	20	52	13, 25	18	33.4	2.70
Emmittsburg	9	76	13, 28	24	42.1	......	2	52	11	8	28.7	......
Mt. St. Mary's Col.	9	72	28	23	42.1	5.87	17	42	12	11	28.3	2.26
Averages	......	......	......	......	45.1	5.93	......	......	......	......	31.2	1.91
VIRGINIA.												
Surry C. H.	10	82	24	25	48.4	......	20	67	13	10	37.6	......
Johnsontown	10	77	13	32	49.3	......	21	58	13	15	37.4	......
Comorn	9, 10	74	19, 23, 24	32	45.8	2.55	......	......	25	10	......	1.42
Staunton	9	75	13, 14, 24, 28	29	43.8	2.32	20	51	12	9	32.0	2.67
Mt. Solon	......	......	......	......	......	......	20	62	13	2	34.1	6.00
Lynchburg	10	72	28	33	48.7	......	20	55	12	14	37.4	......
Snowville	10	71	13, 24	20	40.6	5.60	20	63	12	0	30.0	6.10
Wytheville	7, 8, 9, 10	68	13, 28	21	39.8	1.25	18	50	12	—10	29.5	3.20
Averages	......	......	......	......	45.2	2.93	......	......	......	......	34.0	3.88
WEST VIRGINIA.												
Romney	9	76	28	22	42.4	......	28	52	13	4	28.5	......
White Day	8	75	23	26	46.0	......	17, 19, 20, 28	50	12	10	33.3	......
Averages	......	......	......	......	44.2	......	......	......	......	......	30.9	......
NORTH CAROLINA.												
Kenansville	10	76	22, 23, 25	31	50.0	2.05	......	......	......	......	......	......
Goldsboro'	10	77	24	28	50.1	1.60	18, 20	65	25	15	41.2	1.33
Raleigh	8, 10	78	13, 14	29	49.6	1.45	20	63	12	12	38.7	3.60
Oxford	10	75	14	27	45.6	2.10	20	56	12	8	34.0	1.55
Albemarle	10	82	23	18	44.5	1.00	20	64	25	4	35.5	4.44
Statesville	10	72	23	20	41.6	2.00	20	55	12	0	32.1	4.75
Asheville	9	70	14	21	42.5	......	20	60	12	— 1	33.5	......
Averages	......	......	......	......	46.3	1.70	......	......	......	......	35.8	3.13
SOUTH CAROLINA.												
Aiken	11	79	21	33	......	......	20	69	25	12	42.4	2.67
Gowdeysville	10	78	21	30	51.2	......	19	65	12	4	38.3	......
Averages	......	......	......	......	51.2	......	......	......	......	......	40.4	2.67
GEORGIA.												
Atlanta	9	74	13, 27	27	44.2	3.12	20	62	12	6	37.4	5.12
Macon	10	75	21, 23	31	50.1	0.51	20	69	12	13	41.9	5.32
Penfield	10	75	21	28	48.8	0.63	20	64	12	12	39.9	3.85
Averages	......	......	......	......	47.7	1.42	......	......	......	......	39.7	4.76
ALABAMA.												
Opelika	9	78	23	25	43.8	2.94	20	67	12	11	44.6	4.12

Meteorology of 1868—Continued.

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
ALABAMA—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Carlowville	9	79	21	28	52. 2	3. 44	20	68	12, 25	16	42. 1	6. 90
Moulton	9	69	21, 23	28	46. 1	3. 00	20, 30	59	25	12	39. 0	2. 96
Greene Springs	8	72	21	26	47. 1	4. 17	31	69	25	11	43. 3	4. 19
Havana	8	73	21	26	48. 0	3. 45	31	65	25	15	42. 6	5. 08
Fish River	9	76	21, 22	34	......	......	30	69	24, 25	26	......	2. 75
Averages	......	......	......	......	48. 4	3. 40	......	......	......	......	42. 3	4. 33
FLORIDA.												
Jacksonville	10	85	21	35	58. 8	0. 25	4, 19, 31	72	25	20	57. 1	2. 05
Port Orange	......	......	......	......	......	......	31	71	25	22	53. 4	......
Averages	......	......	......	......	58. 8	0. 25	......	......	......	......	55. 3	2. 05
TEXAS.												
Gilmer	4	80	21	29	51. 5	6. 68	20	78	11	18	46. 7	5. 18
Houston	3, 8, 9	76	17	55	64. 6		......	......	......	......	......	......
Columbia	9	88	11	35	58. 1	5. 97	20	81	11	24	51. 9	8. 84
Waco	8	83	17	32	54. 4	3. 05	19	72	11	18	45. 7	4. 95
Austin	8	83	12	34	55. 7	4. 17	19	74	25	21	48. 4	4. 96
Averages	......	......	......	......	56. 9	4. 97	......	......	......	......	48. 2	5. 98
LOUISIANA.												
New Orleans	9	79	21	42	......	......	28	72	25	32	......	......
Benton	4, 7, 8, 9	80	21	28	51. 2	......	20	76	11	18	44. 9	......
MISSISSIPPI.												
Grenada	8, 9	78	21	27	51. 3	......	19	70	25	14	......	......
Brookhaven	9	79	21, 22	30	50. 8	......	19	66	25	16	45. 7	......
Natchez	9	79	21	28	51. 5	5. 67	19, 29, 30	68	25	16	46. 8	4. 11
Averages	......	......	......	......	51. 2	5. 67	......	......	......	......	46. 3	4. 11
TENNESSEE.												
Elizabethton	10	74	12	24	42. 8	......	20	62	12	— 8	32. 6	......
Tusculum Col.	......	......	......	......	......	......	19	58	12	— 9	32. 2	0. 92
Lookout Mount'n.	9	72	20	26	48. 7	......	30	58	12	2	39. 5	......
Austin	9	78	12, 19, 23, 28	22	45. 2	3. 65	19	64	12	4	37. 3	7. 00
Clarksville	8	74	23	25	44. 7	2. 02	19, 20	59	11, 12	1	33. 4	5. 37
Memphis	8	78	23	26	46. 8	2. 14	19	63	11	8	36. 6	4. 27
Averages	......	......	......	......	45. 6	2. 60	......	......	......	......	35. 3	4. 39
KENTUCKY.												
Pine Grove	9	74	12, 20, 23	26	42. 4	2. 33	19	56	12	— 3	31. 2	3. 45
Lexington	9	74	12	24	43. 0	3. 24	19	58	12	— 2	29. 8	3. 77
Danville	9	79	12	24	47. 3	2. 28	19	64	12	— 4	35. 4	4. 13
Louisville	9	76	12, 23, 27	24	44. 4	2. 26	19	59	12	— 1	31. 1	4. 01
Clinton	9	75	23	21	42. 8	1. 95	20	55	11	2	28. 8	......
Averages	......	......	......	......	44. 0	2. 41	......	......	......	......	31. 3	3. 84
OHIO.												
New Lisbon	10	80	3	22	44. 5	2. 58	5, 18	52	11, 12	10	30. 3	1. 76
Steubenville	9	69	3, 27	29	43. 2	......	20	49	12	10	30. 1	......
Painesville	4, 9	56	30	28	40. 4	5. 55	20	46	12	5	25. 8	4. 30
Milnersville	9	71	27	19	38. 4	1. 86	......	......	......	......	......	......
Cleveland	16	66	27	27	40. 3	3. 73	20	48	12	3	26. 3	1. 48
Wooster	9	67	27	24	42. 2	2. 45	20	55	12	2	27. 8	0. 70

Meteorology of 1868—Continued.

Stations in States and Territories.	November.						December.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
OHIO—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Kelley's Island	4	70	18, 19, 20	31	41.8	2.24	20	46	12	1	27.1	0.45
Sandusky	4	59	27	27	39.7	2.57	20	52	12	0	25.1	0.84
Norwalk	3	67	27	27	41.3	1.94	20	52	12	0	26.1	0.90
No. Fairfield	4, 14, 15	63	12, 20	27	41.6	2.37	20	51	12	— 3	26.5	0.69
Westerville	9	70	23	22	40.9	1.35	20	51	12	0	27.9	1.45
Marion	9	67	12, 20, 22, 24	25	39.5	2.10	20	50	12	— 3	25.0	0.87
Hillsboro'	9	70	20	24	41.7	1.83	19, 20	49	12	— 1	26.3	2.34
Toledo	13	62	20	25	39.5	2.88	20	44	12	— 3	25.2	1.06
Bowling Green	3	65	27	23	40.7	3.00	20	50	12	— 3	26.2	2.55
Urbana Univ	9	70	12	21	40.4	1.77	20	50	12	— 6	25.7	1.57
Bethel	9	70	12	22	41.0	1.08	20	52	12	— 4	26.7	3.00
Jacksonburg	9	72	12, 20, 23	26	43.0	2.25	20	52	12	— 9	26.6	2.00
Cincinnati (H.)	9	73	12	26	42.8	1.70	19	55	12	0	29.1	2.07
Do (P.)	8, 16	70	20	30	46.6	1.16	2	58	12	2	33.1	2.12
College Hill	9	72	19, 20, 24	28	43.2	1.80	20	52	12	— 6	27.3	3.96
Averages	......	......	......	......	43.6	1.81	......	......	......	......	27.2	1.80
MICHIGAN.												
Monroe City	3	54	6, 27	18	34.1	3.61	20	40	12	— 7	20.7	1.30
State Agric'l Col	3	58	27	16	36.8	3.44	17	42	11	—15	21.2	1.35
Litchfield	30	60	27	21	37.8	2.67	17, 19, 20	36	12	— 2	19.3	2.30
Cold Water	15	60	18, 27	22	36.7	3.69	18, 19	40	12	— 8	21.8	......
Grand Rapids	13, 14	54	19	21	36.5	......	17	44	11, 26	8	24.4	2.27
Northport	3	46	30	24	35.4	3.78	16, 17	38	10	10	25.3	1.20
Muskegon	3	60	26	24	38.4	3.00	17	58	16	10	28.1	1.50
Holland	14, 15	57	18, 19, 27	25	38.2	5.20	17, 19	42	16	1	26.4	2.29
Otsego	8	66	23	26	39.4	......	3	44	26	6	27.0	......
Copper Falls	2	46	30	15	31.3	3.55	17	34	9	— 4	17.2	0.54
Ontonagon	3, 7, 18	46	27	24	36.2	3.60	16	40	12, 13	0	23.0	......
Averages	......	......	......	......	36.4	3.62	......	......	......	......	23.1	1.59
INDIANA.												
Aurora	9	74	11, 12	24	40.7	1.63	19	52	12	— 6	26.7	2.46
Vevay	9	78	23, 27	28	44.1	1.73	19	57	12	— 2	30.1	2.82
Muncie	15	66	12, 24	23	41.9	2.77	19	54	12	— 5	26.2	0.85
Spiceland	9	67	12, 24	25	41.0	1.46	19	53	12	— 6	26.0	1.25
Columbia City	......	......	......	......	......	......	20	40	12	—10	23.5	0.90
Jalapa	9, 16	62	12	28	42.5	4.43	19	51	11, 12	— 4	27.8	2.18
Knightstown	9	70	12	24	42.3	1.87	19	52	12	—10	24.5	1.53
Indianapolis	14	67	24	25	41.5	1.29	19, 20	49	10	1	26.8	1.62
State University	8, 9	70	12, 27, 29	26	42.1	1.34	19	56	12	—10	27.4	1.54
Rensselaer	3, 6	62	1, 17, 18, 23, 27	26	38.9	5.45	18	48	11	—18	22.2	1.60
Merom	8	71	11	27	42.6	1.70	19	56	11, 12	—11	29.1	2.25
New Harmony	8	75	23, 27	28	44.6	1.96	19	58	11	— 2	30.9	1.92
Averages	......	......	......	......	42.0	2.33	......	......	......	......	26.7	1.74
ILLINOIS.												
Chicago	3	62	18	26	41.9	2.60	19	48	11	—11	25.3	1.41
Near Chicago	3	60	19	12	34.3	......	19	44	12	—18	20.2	......
Marengo	13	62	18, 19	18	36.2	3.18	19	47	11, 12	—13	20.8	1.38
Golconda	9	80	12	22	51.9	1.00	19	66	11	0	34.9	3.30
Aurora	3	58	19	13	37.6	2.55	......	......	......	......	......	......
Sandwich	15	58	19	11	36.4	3.00	18	41	12	—18	19.7	0.60
Belvidere	4	61	18	14	36.5	3.36	17	43	11, 12	—16	20.7	1.40
Winnebago	3	60	18	11	35.6	3.34	17	42	10	—16	18.2	1.30
Rochelle	3	66	19	10	36.2	......	19	44	11	—22	20.2	0.85
Wyanet	3	70	22	15	39.2	3.57	19	48	11	—18	22.9	1.20
Tiskilwa	15	62	19	20	39.3	......	19	47	11	—14	20.2	0.72
Hennepin	3	64	19	20	38.0	......	17	45	11	—16	25.0	......
Elmira	3	64	19	20	38.5	3.20	19	47	11	—20	17.9	1.36

Meteorology of 1868—Continued.

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
ILLINOIS—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Peoria	3	65	17, 19	25	41.3	4.50	19	54	11	—13	25.0	1.81
Springfield	3, 8	70	17, 18, 20	26	41.1	......	19	62	11	—18	25.6	......
Loami	7	70	17	22	41.0	5.15	19	55	11	—18	24.6	3.10
Dubois	4	65	11	20	40.3	1.52	19	60	11	— 8	20.7	2.30
Waterloo	8	73	19	29	46.4	......	......	......	......	......	......	......
South Pass	8	74	20	26	44.6	......	19	60	11	—10	30.3	......
Galesburg	8	66	17, 18, 19	25	40.4	3.74	19, 30	46	11	—17	22.0	0.40
Manchester	7	72	17	23	42.1	3.12	19	57	11	—15	26.4	2.25
Mount Sterling	7	75	11	24	41.8	......	19	57	11	—18	25.0	......
Andalusia	3	60	11, 19	24	39.9	......	19	47	11	—12	22.7	......
Augusta	3, 15	61	19	25	40.8	5.02	19	52	11	—19	23.5	2.67
Averages	......	......	......	......	40.1	3.26	......	......	......	......	23.7	1.63
WISCONSIN.												
Manitowoc	3	57	18, 27	22	36.0	3.04	17	43	10	— 8	22.0	0.67
Plymouth	3	54	27	17	32.8	4.40	19	41	10	— 9	19.0	1.10
Hingham	3	58	18	17	35.5	......	17, 19	42	10	— 8	20.5	......
Milwaukee	4	65	18	20	37.0	3.23	19	48	11	— 8	22.5	0.88
Appleton	3	57	27	21	36.4	......	19	43	10	— 6	21.5	0.93
Geneva	3	62	18	18	36.1	5.70	......	......	......	......	......	......
Waupacca	3	58	18	20	35.5	......	19	42	10	— 8	20.7	......
Embarrass	3	56	27	16	31.4	3.53	19	36	12	—13	17.8	1.45
Rocky Run	3	60	27	16	34.6	4.94	17	44	10	—10	20.0	0.72
Edgerton	3	62	18	16	36.9	......	19	45	10	—14	18.8	1.15
Bayfield	......	......	......	......	......	......	16	40	11	— 6	17.2	......
Averages	......	......	......	......	35.2	4.14	......	......	......	......	20.0	0.99
MINNESOTA.												
Beaver Bay	7	48	22, 27	16	31.7	3.70	3	40	9	—14	17.3	1.10
St. Paul	2	57	11	10	31.1	3.68	16, 17, 19	36	11	—17	16.4	0.58
Minneapolis	2	59	27	10	30.5	4.13	17	37	10	—19	15.2	0.55
Sibley	2	60	27	3	31.3	3.00	16	36	10, 11	—20	13.4	0.65
New Ulm	2	62	27	8	32.4	3.73	19	38	10	—18	16.0	0.61
Sauk Center	2	57	26	3	27.5	2.73	5	33	10	—23	12.7	1.53
Averages	......	......	......	......	30.8	3.50	......	......	......	......	15.2	0.84
IOWA.												
Clinton	13	64	18	14	41.0	4.45	17	50	11	—15	22.6	1.10
Davenport	3	61	19	21	36.5	4.77	19	45	11	—17	20.1	1.22
Dubuque	3	60	18	17	37.3	1.18	17, 19	42	11	—10	20.3	2.18
Monticello	3	62	11, 17	18	36.4	2.05	19	42	11	—18	15.0	0.77
Bowen's Prairie	2, 15	60	17	18	36.2	4.50	19	46	10	—20	19.8	5.30
Muscatine	3	61	19	21	38.1	2.71	......	......	......	......	......	......
Fort Madison	3	65	11, 17	22	42.2	4.02	19	50	11	—20	25.0	1.84
Guttenberg	3	62	27	12	34.5	......	17	44	11	—22	16.2	......
Mount Vernon	14	62	11, 17	18	36.3	......	19	44	11	—16	19.4	......
Iowa City	2, 3	63	17	18	38.0	4.38	19	50	11	—18	21.2	1.62
Independence	2	62	27	14	34.5	1.90	19	43	11	—22	16.8	......
Near Independ'e	14	63	27	10	31.9	2.70	19	44	11	—24	14.5	0.81
Waterloo	2, 3, 14	62	26	14	36.2	......	19	42	11	—19	19.0	......
Marble Rock	14	54	27	19	34.1	......	19	48	11	—13	19.6	0.95
Iowa Falls	2	64	27	17	36.2	2.65	19	42	10, 11	—12	......	2.46
Algona	2	64	11, 26	12	31.1	......	17	43	10	—17	16.2	......
Near Algona	2	68	27	9	30.7	......	19	38	10	—18	14.4	2.71
Fort Dodge	2	64	17	18	22.9	1.04	19	41	10	—18	17.0	1.95
Boonesboro'	2	64	27	13	33.1	1.52	......	......	11	—20	......	......
Rolfe	2	71	27	7	31.3	1.65	19	43	10	—27	12.9	2.07
Fontenelle	14	67	17	14	35.3	1.48	17	42	11	—21	18.8	1.90
Logan	2	72	27	10	33.6	2.40	17	45	11	—20	20.0	2.94
Woodbine	2	70	27	10	33.7	......	......	......	......	......	......	......
Averages	......	......	......	......	35.3	2.71	......	......	......	......	18.4	1.99

Meteorology of 1868—Continued.

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain and melted snow.
MISSOURI.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
St. Louis Univer'y.	8	73	19	31	45. 7	1. 90	19	59	11	— 4	30. 4	2. 73
Allenton	3, 8	77	23	18	42. 9	2. 01	19	64	11	—10	28. 5	3. 22
Hematite	8	78	23	19	46. 4	2. 05	17	66	11	— 6	31. 8	3. 45
Canton	3	66	11, 27	26	40. 9	5. 01	19	56	11	—12	25. 7	2. 33
Rolla	8	75	23	20	42. 9	1. 47	19	68	11	— 8	29. 3	2. 56
Jefferson City	7	79	19	26	46. 0	......	19	68	11	—12	26. 0	1. 60
Hermitage	8	81	22	20	42. 0	3. 35	19	62	11	—14	26. 9	3. 42
Warrensburg	7	73	16	23	42. 9	5. 01	19	59	11	—18	27. 6	2. 25
Harrisonville	3	72	17, 19, 20	20	40. 5	6. 20	19	54	11	—15	26. 0	4. 86
Oregon	2	78	19, 26, 27	19	39. 1	3. 05	18	55	11	—16	24. 0	2. 17
Averages	......	......	......	......	42. 9	3. 34	......	......	......	......	27. 6	2. 86
KANSAS.												
Atchison	2	78	26	17	38. 8	8. 40	17, 18	50	11	—17	24. 3	2. 20
Leavenworth	2	74	26	16	37. 9	5. 17	18, 19, 20	46	11	—19	23. 0	2. 17
Olatha	2	73	17, 19	20	......	5. 70	19	54	11	—20	24. 2	3. 50
Baxter Springs	8	79	19	22	45. 4	4. 00	19	70	11	— 6	33. 8	3. 05
Lawrence	2	73	26	17	38. 0	4. 14	19	49	11	—16	24. 3	2. 13
Holton	2	77	26	15	37. 7	......	17, 18, 20	46	11	—19	25. 6	2. 70
State Agric'l Coll.	2	71	26	16	38. 1	2. 72	28	57	11	—16	25. 3	0. 81
Council Grove	2	78	27	20	42. 3	3. 45	20	50	11	—15	28. 0	3. 15
Averages	......	......	......	......	39. 7	4. 80	......	......	......	......	26. 1	2. 46
NEBRASKA.												
Dakota	2	68	27	7	34. 1	......	16	49	11	—19	20. 7	......
Omaha Mission	2	73	17	16	36. 5	1. 36	16	48	10, 11	— 8	24. 0	1. 50
Elkhorn	2	73	27	13	34. 2	......	2	45	11	—15	20. 5	......
De Soto	2	70	27	11	33. 3	1. 18	17	46	11	—15	19. 9	2. 00
Omaha City	14	73	16, 17	18	37. 3	......	17	50	10	—12	21. 8	1. 81
Bellevue	2	71	27	17	37. 1	0. 50	17	45	11	—20	22. 5	6. 40
Glendale	2	75	27	9	33. 9	1. 90	17	45	11	—30	19. 4	2. 10
Nebraska City	2	71	16, 17, 19, 27	20	38. 1	2. 10	17	49	11	—17	23. 2	2. 58
Averages	......	......	......	......	35. 6	1. 41	......	......	......	......	21. 5	2. 73
UTAH.												
Wanship	......	......	......	......	......	......	17	52	6	3	27. 3	1. 40
CALIFORNIA.												
Monterey	1	82	9	36	57. 5	1. 42	7	66	9	34	51. 8	4. 30
Murphy's	......	......	......	......	......	......	15, 16	68	8	22	44. 0	5. 20
Averages	......	......	......	......	57. 5	1. 42	......	......	......	......	47. 9	4. 75

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